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Country Line Creek

Watershed Work Plan

Rockingham and Caswell Counties
North Carolina



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ADDENDUM

To The

WATERSHED WORK PLAN COUNTRY LINE CREEK WATERSHED ROCKINGHAM AND CASWELL COUNTIES, NORTH CAROLINA

CONTENTS

Introduction

Part I - Effects of evaluation structural measures using
current values for benefits and costs, and the
current discount rate.

Part II - Display accounts for impacts of:

National Economic Development
Regional Development
Environmental Quality
Social Well-Being

Part III - Abbreviated Environmental Quality Alternative
Plan

November 1975

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A D D E N D U M

Country Line Creek Watershed Work Plan

I N T R O D U C T I O N

This addendum is based on procedures established for application of the Water Resources Council's Principles and Standards to implementation studies in process.

The Country Line Creek Watershed Work Plan dated July 1975, was developed using 1973 prices for structural installation, operation and maintenance, and for non-agricultural benefits; a 5 5/8 percent discount rate; adjusted normalized prices for agricultural products, and recreation values based on Senate Document 97 in the evaluation of structural measures.

Part I of this addendum shows the effect of evaluating the structural measures using 1975 installation costs, a 6 1/8 percent discount rate, current normalized prices for agricultural products, current prices for values other than agricultural products, and current recreation values in the evaluation of the project structural measures.

Part II of the addendum displays the effects of the selected plan as evaluated for each of the separate accounts - national economic development, environmental quality, regional development, and social well-being. Values for costs, prices, and rates are those of the July 1975 work plan.

Part III of the addendum displays an abbreviated alternative plan developed to emphasize environmental quality. Bases for costs, prices and rates are equivalent to those used for the July 1975 work plan.

ADDENDUM PART I

COUNTRY LINE CREEK WATERSHED

WORK PLAN

EFFECT OF USING CURRENT VALUES FOR EVALUATIONS

The following tabulation shows the effect of evaluating the structural measures using a 6 1/8 percent discount rate, 1975 installation costs, current prices for values other than agricultural products, current normalized prices for agricultural products, and current recreation values.

Average Annual Costs	\$477,900
Average Annual Benefits:	
Primary Benefits	498,580
Secondary	57,750
Total Benefits	556,330
Benefit to Cost Ratios:	
Total Benefits to Cost	1.16 to 1.0
Without Secondary Benefits	1.04 to 1.0

Tables with details of these costs and benefits are on Addendum, Part I, pages I-2 through I-8.

November 1975

Installation Cost Item	Unit	Number	Estimated PL-566 Non-Federal Land	Cost	Other Non-Federal Land	Dollars ^{1/}	Total
	Land	FS	FS	SCS	FS		

LAND TREATMENT

Land Areas <u>2/</u>	Acres	2,599		203,900		203,900	
Cropland	to	2,163		279,500		279,500	
Grassland	be	4,225		85,000		85,000	
Forestland	Treated	628		58,400		58,400	
Other Land							
Going Cooperative Forest							
Fire Control Program							
Critical Area Stabilization							
Tree Planting	30		3,700	12,500	33,000	33,000	33,000
Grasses and Legumes	37		12,500	4,200	600	600	4,300
Technical Assistance			59,800	53,000	112,800	10,800 ^{3/}	16,700
							171,500
TOTAL LAND TREATMENT			72,300	56,700	129,000	593,900	129,400
							723,300
							852,300

STRUCTURAL MEASURES

Construction	No.	2	1,649,700	1,649,700	1,711,300	1,711,300	3,361,000
Multiple-Purpose Structures			577,500	577,500	577,500	577,500	1,155,000
Recreational Facilities					5,500	5,500	5,500
Water Intake			2,227,200	2,227,200	2,294,300	2,294,300	4,521,500
Subtotal - Construction							
Engineering Services			224,250	224,250	137,750	137,750	362,000
Relocation Payments			53,570	53,570	59,930	59,930	113,500
Project Administration							
Construction Inspection			395,500	395,500	35,000	35,000	430,500
Other			191,000	191,000	16,500	16,500	207,500
Relocation Assistance Advisory							
Services					1,500	1,500	1,500
Subtotal - Administration			586,500	586,500	53,000	53,000	639,500
Other Costs							
Land Rights			378,200	378,200	757,800	757,800	1,136,000
TOTAL STRUCTURAL MEASURES			3,469,720	3,469,720	3,302,780	3,302,780	6,772,500

TOTAL PROJECT

Price Base: 1975	3,542,020	56,700	3,598,720	3,896,680	129,400	4,026,080	7,624,800
Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed and dollar amounts apply to total land areas.							
Includes \$3,000 from the going Cooperative Forest Management Program.							

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

(Dollars)^{1/}

Item	Installation Cost		P.L. 566 Funds		Installation Cost		Other Funds		Total	
	Construction:Engineering	Relocation: Payments	Land: Rights	Total: P.L. 566	Construction:Engineering	Relocation: Payments	Land: Rights	Other	Installation: Cost	Cost
Multiple-Purpose Structure No. 1	740,000	59,000	2,360	801,360	1,138,000	91,000	2,640	372,000 ^{2/}	1,603,640	2,405,000
Water Intake					5,500	500		6,000		6,000
Multiple-Purpose Structure No. 4	909,700	119,000		200,200 ^{3/}	1,228,900	573,300		207,800 ^{3/}	781,100	2,010,000
Recreation Facilities	577,500	46,250	51,210	178,000 ^{4/}	852,960	577,500	46,250	57,290	178,000 ^{4/}	859,040
Subtotal	2,227,200	224,250	53,570	378,200	2,883,220	2,294,300	137,750	59,930	757,800	3,249,780
Project Administration	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	586,500	xxxxxxx	xxxxxxx	xxxxxxx	53,000	639,500
GRAND TOTAL	2,277,200	224,250	53,570	378,200	3,469,720	2,294,300	137,750	59,930	757,800	3,302,780
										6,772,500

1/ Price base: 1975

2/ Includes \$18,000 for modification of a public road and \$2,000 for land for access facilities

3/ Includes \$50,000 for rerouting of Secondary Road 1736

4/ Includes \$52,000 for purchase of houses

Date: November 1975

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

(Dollars) ^{1/}

Item	COST		ALLOCATION				COST				SHARING	
	:		:		:		:		:		:	
	Flood :	Prevention:	M&I :	Water :	Total :	Flood :	Prevention:	M&I :	Water :	Total :	Flood :	Other :
	Recreation:					Recreation:					Recreation:	Water :
Multiple-Purpose Structure No. 1	852,470		1,311,180	2,163,650		800,900	390 ^{2/}	801,360	51,500	1,310,790	1,362,290	
Specific Costs:												
Water Intake			6,000								6,000	
Land Rights	27,600		213,750	241,350					27,600	213,750	241,350	
Multiple-Purpose Structure No. 4	363,400	1,238,600		1,602,000		363,400	665,300	1,028,700		573,300		
Specific Costs:												
Land Rights	7,600	400,400		408,000			200,200	200,200	7,600	200,200	207,800	
Basic Facilities		1,712,000		1,712,000			852,960	852,960		859,040		
GRAND TOTAL	1,251,070	3,351,000	1,530,930	6,133,000		1,164,370	1,718,460	390	2,883,220	86,700	1,632,540	3,249,780

1/ Price base: 1975

2/ Relocation Cost

Date: November 1975

TABLE 2B - RECREATIONAL FACILITIES
ESTIMATED CONSTRUCTION COSTS

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

(Dollars)^{1/}

Item	: : Number	: : Unit : Cost	: Estimated : Construction : Cost	: Total
Parking Space	450	250		112,500
Picnic Table	145	200		29,000
Water Fountains	26	125		3,250
Grills	100	75		7,500
Waste Receptacle Holder	75	50		3,750
Boat Ramp and Dock	4	3,000		12,000
Rest Room	9	11,400		102,600
Camp Site	120	1,900		228,000
Picnic Shelter	4	10,000		40,000
Shower House	1	24,000		24,000
Sewage Disposal Plant	4	30,000		120,000
Water Supply & Distribution	1	36,000		36,000
Electric Distribution System	1	12,000		12,000
Horseback Trail - Mile	3.0	850		2,550
Improve Existing Roads - Mile	3.7	12,000		44,400
New Roads - Mile	4.3	44,500		191,350
Fencing - Mile	4.0	5,000		20,000
Miscellaneous (identification and directional signs, etc.)	----	-----		1,000
Landscaping	----	-----		14,500
Subtotal				1,004,400
Contingencies (15%)				150,600
Total Estimated Construction Cost				1,155,000

^{1/} Price Base: 1975

November 1975

TABLE 4 - ANNUAL COST

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

(Dollars)^{1/}

Evaluation Unit	: Amortization of Installation Cost ^{2/}	: Operation and Maintenance Cost	: Total
Multiple-Purpose Structure Nos. 1 and 4 with Recreation Development at Structure No. 4	376,630	62,000	438,630

Project Administration	39,270	xxxxxx	39,270
GRAND TOTAL	415,900	62,000 ^{3/}	477,900

^{1/} Price base: 1975^{2/} 100 years at 6 1/8 percent interest^{3/} Includes \$60,000 for operation, maintenance and replacement of equipment for recreational development.

Date: November 1975

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD
DAMAGE REDUCTION BENEFITS

County Line Creek Watershed
Caswell and Rockingham Counties, North Carolina
(Dollars)^{1/}

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without	With	
	Project	Project	
Floodwater			
Crop and Pasture	16,835	5,410	11,425
Other Agricultural	5,230	2,040	3,190
Non-Agricultural (Roads & Bridges)	1,130	225	905
Subtotal	23,195	7,675	15,520
Sediment			
Overbank Deposition	9,265	1,280	7,985
Swamping	7,990	525	7,465
Reservoirs	26,100	8,140	17,960
Subtotal	43,355	9,945	33,410
Erosion			
Flood Plain Scour	660	260	400
Streambank	435	200	235
Subtotal	1,095	460	635
Indirect	8,540	2,540	6,000
Total	76,185	20,620	55,565

^{1/} Price base: Current Normalized and 1975

Date: November 1975

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Country Line Creek Watershed
 Caswell and Rockingham Counties, North Carolina

(Dollars)

Evaluation Unit	Average		Annual		Benefits		1/		Average		Benefit	
	Damage : Intensive : Land Use	Incidental :	Water : Recreation :	Secondary : Water : Redevelopment :	Recreation :	Total	Annual	Cost	Annual	Cost	Ratio	
All Structural Measures	47,430	17,000	30,800	57,750	100,000	68,900	234,450	556,330	438,630		1.3 to 1.0	
Project Administration	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	39,270	xxxxxx	xxxxxxxxxx	
GRAND TOTAL	47,430	17,000	30,800	57,750	100,000	68,900	234,450	556,330	477,900		1.2 to 1.0	

1/ Price base: Current Normalized and 1975
 2/ From Table 4

3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$8,135 annually

Date: November 1975

PART II

Selected Plan

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Country Line Creek Watershed, North Carolina

<u>Components</u>		<u>Measures of effects^{1/}</u>	<u>Measures of effects^{1/}</u>
Beneficial effects:			
A. The value to users of increased outputs of goods and services			
1. Flood prevention		\$ 44,060	
2. Municipal and industrial water supply		100,000	
3. Recreation		156,300	
4. Utilization of unemployed and under-employed labor resources - project construction and operation and maintenance		47,300	\$257,400
5. Incidental recreation		30,000	25,600
Total beneficial effects		\$377,660	52,000
Adverse effects:			
A. The value of resources required for a plan			
1. Two multiple-purpose structures with recreational facilities			\$335,000
a. Project installation			
b. Project administration			
c. Operation and maintenance			
Total adverse effects			\$ 42,660
Net beneficial effects			

1/ Average annual

December 1974

ENVIRONMENTAL QUALITY ACCOUNT

Crocker Line Creek Watershed, North Carolina

Measures of Effects

Components

Beneficial and adverse effects:

A. Areas of natural beauty.

3. Quality considerations of water and land resources.

11-10

C. Biological resources and selected ecosystems.

D. Irreversible or irretrievable commitments.

1. Project output will make available regional funds and resources that can be used to enhance the physical appearance of 123 farms in the watershed.
2. Create two lakes, with 390 and 640 surface-acres respectively.
3. Convert 1,030 acres of cropland, forestland, and pastureland to permanent water.
1. Reduce soil erosion in the watershed by 10,40 tons annually (394 milligrams per liter).
2. Reduce sediment delivered to watershed outlet by 56,385 tons annually (394 milligrams per liter).
3. Reduce sediment delivered to Kerr Lake by 11,275 tons annually.
4. Bring about a decrease in sediment associated pollutants in watershed streams.
5. Temporarily increase sedimentation during construction.
6. Release treated effluent from the sewage treatment plant at Structure No. 4 into Country Line Creek.
7. Reduce flood damages 73 percent overall and provide for better utilization of the flood plain land.
1. Create 1,030 surface-acres of lake fish habitat.
2. Provide 1,030 surface-acres for migratory waterfowl resting areas.
3. Improve stream flow and fish habitat below structures through low flow augmentation, cold water release, and sediment reduction.
1. Convert 1,030 acres of forestland, cropland, and pastureland to permanent water.
2. Commit 53 acres of forestland for dams and pathways.
3. Commit 655 acres of forestland, pastureland, and cropland to flood pool.
4. Labor, materials, capital, and energy for construction of water control structures.

December 1979

REGIONAL DEVELOPMENT ACCOUNT

Country Line Creek Watershed, North Carolina

December 1974

1/ Average annual

2/ The region is the area within 50 miles of the multiple-purpose structures.

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT (Continued-2)

Country Line Creek Watershed, North Carolina

Components	<u>Measures of effects</u>		<u>Measures of effects</u>	
	<u>Region I</u>	<u>Rest of Nation</u>	<u>Region I</u>	<u>Rest of Nation</u>
B. Employment:				
Beneficial effects:				
1. Increase in the number and types of jobs.				
a. Agricultural employment	6 permanent semi-skilled jobs	--		
b. Employment for project construction	80 man-years of semi-skilled employment during the installation period (6 years)	--		
c. Employment for project operation and maintenance	3 permanent semi-skilled jobs	--		
Total beneficial effects	9 permanent semi-skilled jobs 80 man-years of semi-skilled employment over the installation period (6 years)	--		
C. Population distribution:				
Beneficial effects:	Create 9 permanent semi-skilled jobs in a rural area and 80 man-years of semi-skilled employment over the installation period (6 years)	--		
Adverse effects:	--	--		
D. Regional Economic Base and Stability				
Beneficial effects:	Provide 1,000,000,000 gallons of water for municipal and industrial use in an area with industrial development potential. Create 9 permanent semi-skilled jobs and 80 man-years of employment during the installation period (6 years). Reduce flood hazard on 1,920 acres of flood plain land. Provide 135,000 visitor-days of recreation. Reduce soil erosion in the watershed by 159,450 tons annually.	--		
Adverse effects:	--	--		

9 permanent semi-skilled jobs.
80 man-years of semi-skilled employment over the installation period (6 years)

SOCIAL WELL-BEING ACCOUNT

Country Line Creek Watershed, North Carolina

Measures of EffectsComponents

Beneficial and adverse effects:

A. Real income distribution

1. Create 9 permanent semi-skilled jobs and 80 man-years of semi-skilled employment over the installation period (6 years).
2. Information required for determination of regional income distribution by income class was not compiled during planning.
3. Information required for distribution of local cost by income class was not compiled during planning.

B. Life, health, and safety

1. Reduce the chances for contamination of drinking water by replacing the present inadequate system with an adequate system. Reduce travel time of local workers whose jobs are now outside of Caswell County by providing water for industry in the county.
Improve the quality of public services by attracting tax-paying industries to the county.

C. Recreational opportunities

1. Provide 135,000 visitor-days of recreation in pools of structures

December 1974

PART III
ABBREVIATED ENVIRONMENTAL QUALITY PLAN
Country Line Creek Watershed, North Carolina

Country Line Creek Watershed, located in Caswell and Rockingham Counties, North Carolina, is one of the few areas in the piedmont section of the state that has escaped the urbanization rush of the past decade. Sixty-eight percent (60,035 ac) of the watershed area is forestland, 29 percent (25,654 acres) is in open agricultural land, and only 3 percent (3,084 acres) urban, roads, etc.

Recreational opportunities, especially waterbased, are very limited within the watershed. Presently the only public water-based recreation is fishing in the creek where access is possible at road crossings. Other water-based recreation (boating, swimming, etc.) in the watershed is available only to individuals owning private lakes or ponds.

The quality of agricultural lands in the watershed is threatened primarily by soil erosion. Many areas of open land have already been seriously degraded through loss of the fertile topsoil. Conservation practices were neglected or poorly applied when large acreages were cleared for growing cotton in the 1920's and 1930's. The period of intensive row cropping started the damaging sheet erosion process that is still going on today. An accelerated conservation system is needed on the erosion-prone cropland to reduce the soil losses. Some areas of extremely steep cropland need conversion to other uses such as woods or pasture. Rotation cropping systems which would allow row cropping only every third or fourth year are needed on marginal cropland. Measures to prevent soil erosion in forestlands and to improve their hydrologic conditions should be implemented also. Critical sediment source areas are limited to roadbanks, unpaved roads, and gullies.

The threat of flooding prevents a more intensive use of the land along the streams for crops, causing a heavy cropping stress to be placed on open upland. A reduction in flooding of cropland in the flood plain would enable farmers to move some crops from upland to the flood plain, thereby reducing erosion.

Sediment resulting from the accelerated erosion has been one of the most adverse factors encountered by the fishery resources of the watershed. A biology report indicated the stream channels in the upper reaches of Country Line Creek and its tributaries are covered by a layer of infertile sand. This sandy bottom does not support the lower order organisms in the "food web" or aquatic plant growth. Because of this the fishery resource in the upper reaches is lacking or consists only of species in the dace-trickle classification. Also the channel fill has produced shallow water and low flows during dry periods in the upper stream

sections. Sediment has also been shown to be a major carrier of chemicals dangerous to the fishery (fertilizers, pesticides, etc.). Sediment from the watershed not only affects fish in the watershed itself but also affects those in Dan River and Kerr Lake. Measures which would prevent sediment from getting into watershed lakes and streams and from leaving the watershed would be beneficial to fish as well as other aquatic organisms both in the watershed and in downstream waterways.

The quality of wildlife habitat in the Caswell Wildlife Management Area is excellent. Wildlife on private lands would benefit greatly from the same type of management program as used on these lands. Components of the management program would include food plantings, prevention of pollution, hunting regulation enforcement, etc.

ENVIRONMENTAL QUALITY PLAN COMPONENTS

An accelerated land treatment program would be carried out over the watershed just as in the selected plan. This program would bring about some needed land use conversions as well as protecting the productivity of the cropland, grassland, and forestland of the watershed. Technical assistance for installing the land treatment program would be provided by the Soil Conservation Service through the soil and water conservation districts, and the United States Forest Service through the North Carolina Division of Forest Resources.

Under the environmental quality plan all forested areas of the watershed would be brought under the management program of the Caswell Wildlife Management Area and also under the Cooperative Forestry Management Program. This would be done under agreement between individual landowners and the North Carolina Wildlife Resources Commission and the North Carolina Division of Forest Resources. These two programs would assure that the forestlands are managed in such a way that timber production and wildlife habitat maintenance are compatible to the maximum extent practical.

A third component of the environmental quality plan is the establishment of channel pools in the upper reaches of Country Line Creek. Before construction of the pool a sediment trap would be cleaned out as needed to keep as much coarse material out of the channel pools as possible. Construction of the channel pool would begin by excavating the sand layer along the length of the pool. Next a rock fill or other weir-type structure would be built across the channel. Then fertile soil would be backfilled into the channel pool if such is necessary to support aquatic growth and other organisms. Wildlife plantings would be established around the edge of the pool. These plantings would include both upland wildlife foods and duck foods. The channel pools would be stocked with fish and maintained under a management program. All ponds would be publicly accessible and would provide watershed residents with fishing during the summer and hunting during the winter as well as producing better fish and wildlife habitat.

Sediment traps would be established at the lower end of all major drainage-ways into Country Line Creek. These traps would be constructed so that most of the coarse material will drop out of the water before it empties into Country Line Creek. About 70 such traps would be required. They would be checked regularly under the operation and maintenance program of the environmental quality plan and cleaned out as needed. Sediment collected would be sold, placed in sanitary landfill, or otherwise disposed of in such a manner so as not to detract from the aesthetic value of the countryside.

Presently there are about 75 miles of unpaved roads in the watershed. These roads are usually subject to high erosion rates and contribute significant amounts of sediment to the streams. All of these roads would be paved and where inadequate vegetation exists on roadbanks, suitable vegetation would be established. Paving these dirt roads would not only cut down on erosion and sediment damage but would also cut down on dust during dry weather and mud during wet weather.

A flood plain study would be performed along the length of Country Line Creek and its tributaries to identify the 100-year flood plain. This study would be made assuming watershed characteristics predicted for future conditions. A zoning regulation would be enforced to prevent future developments in the flood plain that are susceptible to flood damage.

Another component of the environmental quality plan would be a multiple-purpose structure providing for a suitable municipal and industrial water supply to meet the county's anticipated future needs. This would be accomplished by means of the same impoundment referred to as structure No. 1 in the planned project. The characteristics of this site lend it as being the most suitable location for the water supply. A cold water intake would be used on the principal spillway system. Provision for a minimum flow orifice would also be made. A municipal and industrial water intake system would be constructed in conjunction with the structure. Wildlife plantings would be established along all open areas adjacent to the shoreline.

The environmental quality plan would also require the establishment of a multiple-purpose structure providing a publicly accessible recreational lake and development. Exactly as the water supply structure described above, this structure would also have a cold water intake and a minimum flow orifice. All capacities would be the same as provided for in structure No. 4 of the selected plan.

In addition this structure would also have a full recreational development around it very similar to the development around structure No. 4 of the selected plan. There would be a 50-foot border of trees or grass maintained along all open areas adjacent to the shoreline of this lake.

Both structures would create large bodies of impounded water which is in short supply in the watershed thereby providing diversity of landscape, plants and animals. This creation would be at the expense of the wildlife habitat provided by the forestland and cropland presently occupying the impounded areas which is now relatively abundant in Caswell County.

Womack's Mill, a grist mill which has been nominated to the National Register of Historic Places, would be moved to an appropriate site, restored, and put into working order as an educational and cultural resource.

A site designated as Cs12 has been identified by an archaeological survey. This site would be preserved in its present condition until the N. C. Department of Cultural Resources determines that it be investigated and evaluated.

Before any construction on the above measures, a thorough search for three rare and endangered animal species which might be found in the watershed would be made^{1/}. These three species include two fish (Roanoke Hogsucker and Big Eye Jumprock) and a salamander (*Hemidactylium scutatum*). If located, special provisions would be made to preserve them and their habitat.

The total installation cost of the environmental quality plan is estimated to be \$9,025,750. Following are the costs for individual elements.

Municipal and industrial water supply - - - - -	\$1,914,750
Recreational structure - - - - -	1,547,400
Recreational development - - - - -	1,548,300
Channel pools (including public access and sanitary facilities) - - - - -	80,000
Sediment basins - - - - -	32,000
Wildlife plantings (other than under land treatment program)-	5,500
Land treatment program - - - - -	852,300
Paving 75 miles of road - - - - -	3,000,000
Search for rare and endangered species - - - - -	20,000
Flood plain study - - - - -	25,500
Total	\$9,025,750

Environmental effects that would result from installation of the environmental quality plan are as follows:

1. Human Resources

- a. Improve water-based recreation opportunities.
- b. Preserve areas for public enjoyment of nature.

^{1/} North Carolina Department of Natural and Economic Resources Preliminary List of Endangered Plant and Animal Species in North Carolina 1973.

- c. Reduce dangers and interruptions resulting from flooding.
- d. Cause nine displacements from dwellings and six farm displacements.
- e. Provide a diversity of landscape.

2. Fish and Wildlife Resources

- a. Improve quality of fish habitat in the upper reaches of Country Line Creek through the establishment of channel pools.
- b. Provide new fish habitat in the impoundments.
- c. Improve fish habitat in ponds and streams through reduction of sediment and sediment-associated pollutants.
- d. Improve fish habitat below structures through low flow augmentation, cold water discharge, and sediment reduction.
- e. Improve wildlife habitat over all the watershed under the Caswell Wildlife Management Area program.
- f. Provide wildlife food (both upland and duck foods) around the water supply structure and channel pools.
- g. Benefit wildlife through certain land treatment practices (field borders, stripcropping, etc.).
- h. Protect rare and endangered species that might exist in the watershed.
- i. Reduce flooding hazard for reproduction of small game in the area below structures.
- j. Convert about 1,100 acres of cropland, forestland, and pastureland to permanent water, dams, and spillways.
- k. Restrict the use of 655 acres of cropland, forestland, and pastureland in the flood pool of the two structures.
- l. Temporarily increase sedimentation during construction.
- m. Adversely affect wildlife habitat around multiple-purpose structure No. 4.
- n. Convert eight miles of stream to reservoir water.
- o. Release treated effluent from the sewage treatment plant at structure No. 4 into Country Line Creek.

- p. Cause nine displacements from dwellings and six farm displacements.
 - q. Restrict wildlife use of 770 acres in the recreation development.
3. Water, Land, and Air Resources
- a. Reduce erosion damages to cropland.
 - b. Reduce overbank deposition and swamping damages resulting from flooding.
 - c. Enhance the appearance of watershed farms through application and maintenance of land treatment measures.
 - d. Improve farm income from sale of forestry products through forestry practices and a management program.
 - e. Improve hydrologic conditions of forestland.
 - f. Reduce sediment load carried by Country Line Creek and its tributaries.
 - g. Reduce dust and associated air pollution along 75 miles of dirt road.
 - h. Maintain the productivity of the land resource base.
 - i. Reduce the possibility of increased damages due to future developments on the flood plain.
 - j. Reduce average annual runoff from the watershed due to evaporation and seepage losses from the two structures.
 - k. Reduce sediment load carried downstream into Dan River and Kerr Lake.
4. Archaeological and Historical Resources
- a. Restore Womack's Mill as an educational and historical resource.
 - b. Preserve archaeological site Csl2.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Approximately 1,100 acres of forestland, cropland, and pastureland would be permanently converted to water, spillways, and dams as a result of the project. Of this area, 150 acres are in cropland or pastureland and the remaining 950 acres are in woodland. In addition, a recreational development

would permanently occupy 770 acres around Structure No. 4. A capital expenditure of approximately \$9,025,750 would be foregone with installation of the project. The labor and energy required to build the structure would also be an irretrievable commitment of resources.

There would be about 655 acres of forestland, cropland, and pastureland in the flood detention pools of these structures, which would be limited to uses which can tolerate periodic flooding. Eight miles of streams would be converted to reservoir water.

WATERSHED WORK PLAN

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

Prepared Under the Authority of the Watershed
Protection and Flood Prevention Act (Public
Law 566, 83rd Congress, 68 Stat. 666), as amended

Prepared By

Caswell County Soil and Water Conservation District
Rockingham County Soil and Water Conservation District
Caswell County Board of Commissioners
Yanceyville Sanitary District

With Assistance By

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, Forest Service

July 1975



WATERSHED WORK PLAN AGREEMENT

between the

Caswell County Soil and Water Conservation District
Local Organization

Rockingham County Soil and Water Conservation District
Local Organization

Caswell County Board of Commissioners
Local Organization

Yanceyville Sanitary District
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of North Carolina

and the

Soil Conservation Service

United States Department of Agriculture

(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan of works of improvement for the Country Line Creek Watershed, State of North Carolina, under the authority of the Watershed Protection and Flood Prevention Act (Public 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan of works of improvement for the Country Line Creek Watershed, State of North Carolina, hereinafter referred to as the watershed work plan, which is annexed to and made a part of this agreement;

Now, therefore in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree that the works of improvement as set forth in said plan can be installed in about six years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan.

1. The Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) will acquire such land rights as will be needed in connection with the works of improvement. The percentages of this cost to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Land Rights Cost</u> (dollars)
Multiple-purpose Structure No. 4, land for dam, spillway, bene- ficial use pool, and 100- foot strip (908 acres)	50	50	272,400
Purchase of existing buildings	50	50	52,000
Relocation of Secondary Road 1736	50	50	50,000
Land for recreational facilities (770 acres)	50	50	231,000
Flowage easements	100	0	6,000
Multiple-purpose Structure No. 1 purchase of 870 acres of land	100	0	261,000
Flowage easements (145 acres)	100	0	21,750
Modification of Secondary Road 1122	100	0	15,000

The Sponsoring Local Organization agrees that all land acquired or improved with P. L. 566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and the Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-656, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation payments	54.0	46.0	113,500

3. The Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operations of the works of improvement.
4. The percentage of the construction costs of the structural measures to be paid by the Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
Multiple-purpose Structure No. 1	58.4	41.6	1,303,000
Water intake	100.0	0	5,500
Multiple-purpose Structure No. 4	37.0	63.0	1,020,000
Recreational facilities	50.0	50.0	966,500

The Sponsoring Local Organization (Caswell County Board of Commissioners) will provide for the labor and equipment needed for installation of the critical area stabilization measures. The Service will provide the needed materials for installation for these measures.

5. The percentages of the engineering cost to be borne by the Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Cost</u> (dollars)
Multiple-purpose Structure No. 1	58.4	41.6	91,000
Water intake	100.0	0	500
Multiple-purpose Structure No. 4	0	100.0	71,000
Recreational facilities	50.0	50.0	77,300

6. The Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) and the Service will each bear the costs of project administration which it incurs, estimated to be \$43,500 and \$409,500, respectively.
7. The Sponsoring Local Organization (Caswell County and Rockingham County Soil and Water Conservation Districts) will obtain agreements from owners of not less than 50 percent of the land above each reservoir and flood-water retarding structure that they will carry out conservation farm or ranch plans on their land.
8. The Sponsoring Local Organization (Caswell County and Rockingham County Soil and Water Conservation Districts) will provide assistance to land-owners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

9. The Sponsoring Local Organization (Caswell County and Rockingham County Soil and Water Conservation Districts) will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
10. The Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuance of invitations to bid for construction work.
11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the sponsor(s) having specific responsibilities for the particular structural measure involved.
14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting non-discrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no persons in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Caswell County Board of Commissioners By C. Frank Murphy
Local Organization
P.O. Box 98
Yanceyville, NC 27379 Title Chairman
Address Zip Code

Date: Oct. 6, 1975

The signing of this agreement was authorized by a resolution of the governing body of the Caswell County adopted at a meeting held on Oct. 6, 1975.

Johnson P.O. Box 98
Secretary, Local Organization Yanceyville, NC 27379
Address Zip Code

Date October 6, 1975

Yanceyville Sanitary District By Ben W. Henty
Local Organization
Yanceyville, NC 27379 Title Chairman
Address Zip Code

Date: Oct. 7, 1975

The signing of this agreement was authorized by a resolution of the governing body of the Yanceyville Sanitary District adopted at a meeting held on Oct. 7, 1975.

Woodrow N. Foster Yanceyville, NC 27379
Secretary, Local Organization Address Zip Code

Date Oct. 7, 1975

Rockingham Soil and
Water Conservation District By Roy Moore
Local Organization

Rt 4 Box 1, Reidsville, N.C. 27320
Address Zip Code

Title Chairman
Date September 23, 1975

The signing of this agreement was authorized by a resolution of the governing body of the Rockingham Soil and Water Conservation District
Local Organization

adopted at a meeting held on September 23, 1975

S. L. Fairchild
Secretary, Local Organization

Rt. 4, Box 1, Reidsville, N.C. 27320
Address Zip Code

Date September 23, 1975

Caswell Soil and Water
Conservation District
Local Organization

P.O. Box 96, Yanceyville, N.C. 27379
Address Zip Code

By J. S. Smith
Title Chairman
Date Oct. 6, 1975

The signing of this agreement was authorized by a resolution of the governing body of the Caswell Soil and Water Conservation District
Local Organization

adopted at a meeting held on Oct 6, 1975

E. M. Ridd
Secretary, Local Organization

P.O. Box 96 Yanceyville, N.C. 27379
Address Zip Code

Date Oct 6, 1975

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

Jane L. Hicks
State Conservationist

Oct 10, 1975
Date

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SUMMARY OF PLAN

Country Line Creek Watershed, consisting of about 88,773 acres, is located in Caswell and Rockingham Counties, North Carolina. Project sponsors are: Caswell County and Rockingham County Soil and Water Conservation Districts, Caswell County Board of Commissioners, and the Yanceyville Sanitary District.

The greatest soil conservation problem facing agriculture in the watershed is accelerated erosion on the open cropland. The next major problem is excessive runoff due to poor hydrologic condition on 60,000 acres of forest land. Public recreational facilities are badly needed and there is also a great need for developing a reliable municipal and industrial water supply. Lack of this resource has thus far limited industrial growth in the watershed and Caswell County in general. Project measures in this plan are aimed at helping to alleviate these problems.

Plans called for an accelerated land treatment program on 2,599 acres of cropland and 2,163 acres of pastureland and hayland in the watershed. Forestry land treatment practices will be applied to 4,255 acres. Approximately 67 acres of critically eroding areas will be stabilized with trees and grass.

Technical assistance for planning and installing land treatment measures on open land will be provided by the Soil Conservation Service through the Caswell County and Rockingham County Soil and Water Conservation Districts. The United States Forest Service, in co-operation with the North Carolina Division of Forest Resources will furnish technical assistance for applying forestry measures. The landowners and operators will maintain land treatment measures under agreement with the Caswell County and Rockingham County Soil and Water Conservation Districts.

Structural measures will consist of two multiple-purpose reservoirs. Structure No. 1 (see project map) will provide a municipal and industrial water supply as well as floodwater storage. A water intake will be constructed in conjunction with this structure. The other structure, No. 4 (see project map), will store water for recreational purposes in addition to its floodwater storage. In addition, there will be a complete recreational development around this structure (see recreational development map). The Yanceyville Sanitary District and Caswell County Board of Commissioners will be responsible for the installation and maintenance of structure No. 1 and the Caswell County Board of Commissioners will have the same responsibility on structure No. 4.

Installation time of the project has been estimated to be six years.

The project, when installed, will provide a total of \$421,510 in average annual benefits. Of this amount, \$6,850 are attributed to land treatment measures and \$414,660 are from structural measures. (See Table 6.) The total project cost has been estimated at \$5,862,750, of which Public Law

Summary

566 funds will pay \$2,708,810, and other funds will pay \$3,153,940. Land treatment constitutes \$852,300 of this cost. The average annual cost of the project (including operation and maintenance expenses) amounts to \$335,000. When compared to the overall annual benefits, this gives a benefit-cost ratio of 1.2 to 1.0.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Data

The watershed, about 88,773 acres in size, is located in parts of Caswell and Rockingham Counties in north central North Carolina. Approximately 86,553 acres are in Caswell County and 2,220 acres are in Rockingham County. Yanceyville (population 1,274) (1) and Milton (population 235) (1) are the only towns located within the watershed, although numerous small communities are dispersed throughout the area. The city of Danville, Virginia (population 46,557) (2) lies about 15 miles to the north and Burlington, North Carolina (population 35,930) (1) is located 25 miles to the southwest.

The watershed is located in subregion 0301 of the South Atlantic Gulf Water Resources Region, as defined by the Water Resources Council (3) (Figure 1). The 276,000 square-mile area of the region extends from the North Carolina-Virginia boundary line at the Atlantic Ocean to the mouth of Lake Pontchartrain on the Gulf of Mexico in Louisiana (4). It includes parts of North Carolina, Georgia, Alabama, Louisiana, Mississippi, and all of South Carolina and Florida. The climate of the South Atlantic Gulf Region (4) is characterized by well-distributed rainfall, mild winters, and warm to hot-humid summers. The average rainfall varies from over 80 inches in the mountains to 44 inches in central Georgia. Annual natural

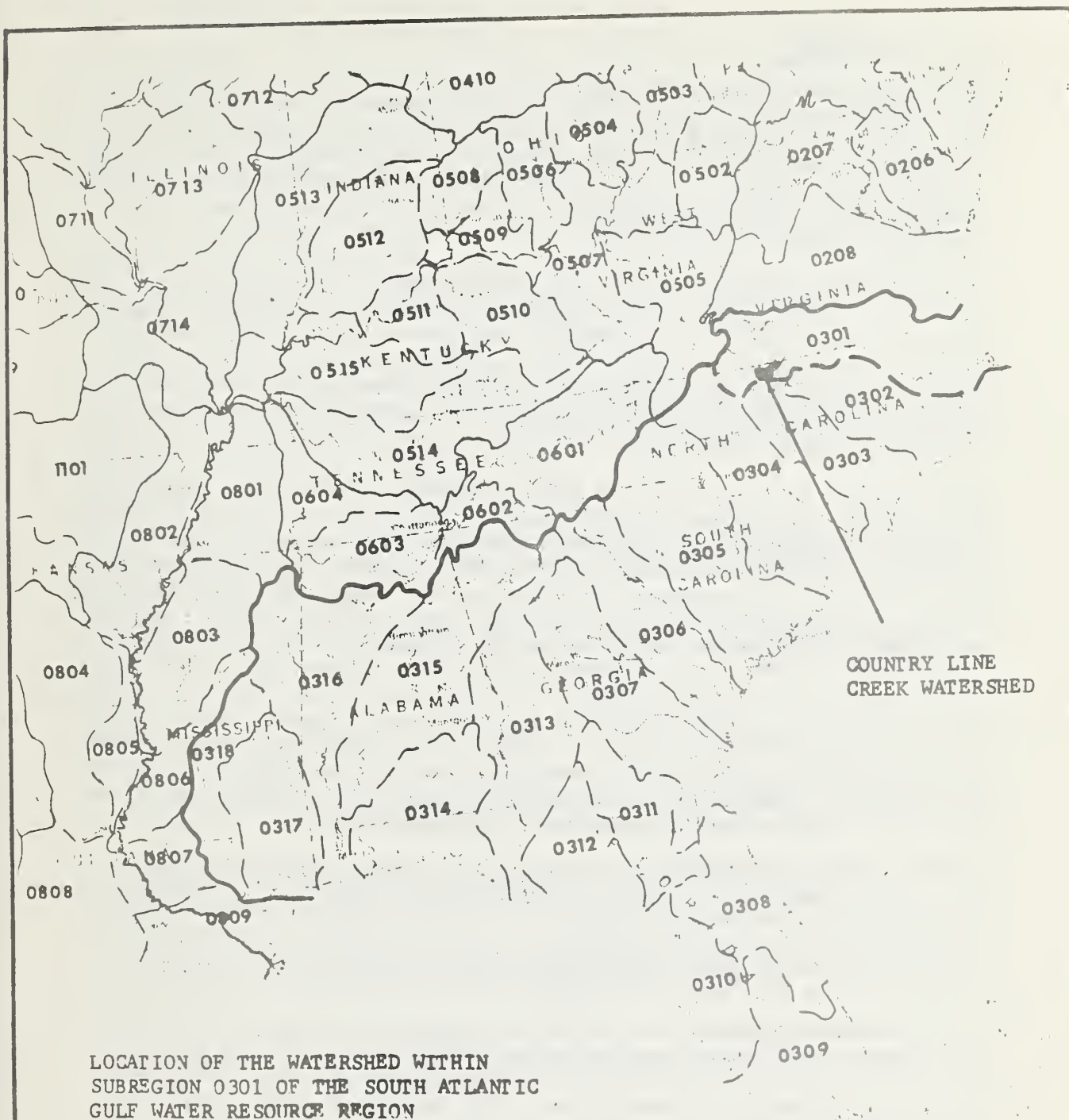


Figure 1
-3-

Resources

runoff ranges from 10.5 inches to 20.8 inches among the subregions; however, variations of individual river basins may be considerable. The quality of streams in the region is generally excellent. Turbidity and color sometimes impair water physical quality in the coastal plain and moderate to sometimes high sediment loads are common. The quality of ground water is suitable for most uses; however, the yield varies considerably, depending on the type aquifer and the location within the region. The topography differs considerably throughout the region from rugged-densely-wooded mountains to rolling, well-drained plains to flatlands, wetlands, and marshes.

Subregion 0301 is made up of the Roanoke River Basin and contains all or parts of 37 North Carolina and Virginia counties. Its physical characteristics are typical of the piedmont and coastal plains of the South Atlantic Gulf Region as a whole. The climatic conditions of the subregion are generally more harsh than other piedmont and coastal plain areas in the South Atlantic Gulf, due to its extreme northerly position within the region (Figure 1).

The watershed is typical of the middle piedmont area of both subregion 0301 and the South Atlantic Gulf Region. It receives a well-distributed rainfall of approximately 45 inches annually (5). Average temperatures range from 42 degrees Fahrenheit in January to 78 degrees Fahrenheit in July (6), although extremes of 106 degrees in summer and zero degrees in winter occur occasionally. The normal growing season is about 220 days long, extending from the middle of April through the last of October (6).

The topography of the Watershed is badly broken by steep slopes adjacent to the streams, and short erratic slopes on the remaining areas. Elevations range from about 700 feet mean sea level in the headwaters to 350 feet mean sea level at the confluence of Country Line Creek and the Dan River. All of the watershed is in the piedmont area.

Crushed stone is currently produced in both Caswell and Rockingham Counties. In addition clay, sand, and gravel are produced in Rockingham County. Presently annual mineral production in the two counties is valued at approximately \$1,000,000. There is no current record of mineral production within the project area. Installation of the project is not anticipated to have an affect on the mineral resource base of the area.

Public ownership consists of 12,700 acres in the Caswell Wildlife Management Area, owned by the State of North Carolina. All of the remaining area, other than roads and public buildings, is privately owned. Of this, the Boy Scouts of America own 1,400 acres, and timber companies own about 970 acres.

The principal land uses in the watershed are as follows:

<u>Land Use</u>	<u>Acres</u>	<u>Percent of Watershed</u>
Cropland	16,287	18
Forestland	60,035	68
Pasture and Hay	7,629	9
Idle	1,738	2
Miscellaneous Land (roads, urban, etc.)	<u>3,084</u>	<u>3</u>
Total	88,773	100

Resources

The cropland in the watershed has been broken down into land capability groups (7). Capability grouping shows, in a general way, the suitability of soils for particular uses. The groups are classified according to the limitations of the soils for particular uses, the risk of damages or losses involved in their use, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils, when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs:

Capability Classes, the broadest groups, are designated Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode, but have other limitations, impractical to remove, that limit their use largely to pasture, range, forestland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, forestland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, range, forestland, or wildlife.

Resources

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to aesthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, e, w, s, or c, to the class numeral; for example, IIe. The letter e shows that the main limitation is risk of erosion, unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils, the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by w, s, or c because the soils in class V are subject to little or no erosion though they have other limitations that restrict their use largely to pasture, range, forestland, wildlife or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants to require similar management and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol; for example, IIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass. The capability unit is oftentimes omitted if all the soils of a certain class and subclass (i.e. IIe) fall in the same capability class and subclass. Capability units have not been included because of the reason stated above.

The approximate acres of each land use in the watershed by capability group are as follows:

Resources

<u>Capability Group</u>	<u>Cropland</u>	<u>Forestland</u>	<u>Hay and Pasture</u>	<u>Idle</u>	<u>Miscellaneous</u>
IIe	7,326	7,265	2,289	521	
IIIe	4,886	8,535	1,526	434	
IVe	1,629	9,100	1,602	191	
VIe	1,955	28,640	1,144	556	
VIIe	163	3,530	610	36	
IIw	-	1,980	-	-	
IIIw	164	210	305	-	
IVw	164	775	153	-	
Any	-	-	-	-	3,084
TOTAL	16,287	60,035	7,629	1,738	3,084

As can be seen from these figures, erosion problems are the most serious problems on the soils in the watershed. The planned land treatment measures are designed to help use this erosion-prone land in the most efficient manner possible.

The principal upland soils are from the Pacolet, Wilkes, and Helena series, with a small amount of Cecil, Appling, and Hiwassee series soils present (8). These soils have developed chiefly from weathered acid and basic crystalline rocks and vary from very shallow to moderately deep. Flood plain soils are members of the Wehadkee and Chewacla series.

Pacolet soils (9) are well-drained, moderately permeable, and very strongly acid soils of the piedmont uplands. They have brownish-yellow sandy loam surface layers and thin red clayey subsoils over a thick weathered rock layer. These soils are on short to medium length slopes adjacent to the bottom lands and drainageways. Slopes are commonly 15 to 40 percent.

The Wilkes soils (9) are well-drained, shallow soils on nearly level to steep topography of the piedmont uplands. Typically, these soils have a grayish-brown sandy loam surface layer and a thin, firm clay subsoil which extends from 12 to 20 inches below the surface. The substratum is saprolite that crushes to a sandy loam or loam texture. Hard rock lies at three to four feet beneath the soil surface. Slopes range from four to 60 percent.

Resources

Consisting of moderately well-drained, slowly permeable subsoils, Helena soils (9) are on nearly level to moderately steep topography of the piedmont. The typical surface layer is a sandy loam about 12 inches thick. The subsoil extends to a depth of about 46 inches and commonly is a plastic sandy clay loam in the upper part over very plastic clay that grades into a silty clay loam in the lower part. Slopes are commonly from two to 10 percent.

Located on flood plains, the Wehadkee series (9) are poorly drained, alluvial soils. Typically, these soils have a grayish-brown fine sandy loam surface layer and a dark gray sandy clay loam subsoil. The substratum is commonly sandy loam or stratified sand, silt, clay, and gravel. Wedhadkee soils are on level or gently sloping areas.

Also found on flood plains, Chewacla soils (9) are likewise alluvial and moderately well-drained to somewhat poorly drained. These soils usually have a brown loam surface layer and a yellowish-brown loam, silt loam to silty clay loam subsoil that is mottled with gray within 24 inches of the surface. Slopes are less than two percent.

Country Line Creek originates just east of the community of Williamsburg in Rockingham County and flows northeast to its confluence with the Dan River at Milton (see project map). Principal tributary streams on the south side of Country Line Creek include Penson, Burkes, Byrds, and South Country Line Creeks. Holster Branch is the main tributary on the north side. The stream pattern of the watershed is primarily dendritic; that is, each stream or tributary branches out into smaller streams. The main stem of Country Line Creek and its major tributaries are permanently flowing streams with an average annual runoff of about 14 inches (10).

There are, at present, no large reservoirs located within the watershed area. The town of Yanceyville has a small water supply reservoir on a tributary of Country Line Creek and there are numerous small farm ponds in private ownership used for recreation, livestock water, irrigation, etc. Hyco Lake is a large hydroelectric power lake located just each of the watershed and is available for limited fishing and boating.

The streams of the watershed have been classified in accordance with the system used by the North Carolina Office of Water and Air Resources, Department of Natural and Economic Resources (11). Country Line Creek from its source to North Carolina Highway 62 is classified "A-II" and is classified "C" from that point downstream to the Dan River (12). Byrds Creek is classified "C" from its source to Secondary Road 1751 and "B" from there downstream to South Country Line Creek (12). South Country Line Creek is classified "C" from source to Secondary Road 1759, classified "B" from there downstream to the proposed dam at structure No. 4 (see project map), and classified "C" below the proposed dam (12). Penson Creek is listed as being in class "C" from

its source to North Carolina Highway 62 and class "B" below this road (12). Burkes Creek is class "C" from the headwaters to North Carolina Highway 62 and class "B" from there to Penson Creek (12). Holster Branch is designated as class "D" in its entire length (12).

The "A-II" classification designates the water as being suitable for a source of water supply, culinary or food processing purposes, after approved treatment equal to coagulation, sedimentation, filtration, and disinfection, etc., and any other usage requiring water of lower quality. Class "B" water is suitable for recreational use (human contact) and other lower quality uses. The "C" classification designates it as being suitable for fish and fish propagation, and any other usages requiring water of lower quality. The "D" classification designates the water as being suitable for agricultural and for industrial cooling and process water, after treatment by the user as may be required under each particular circumstance.

Slack and Wilder of the United States Geological Survey have reported on general water quality of many streams in North Carolina, including Country Line Creek (13). They show the creek to have a average hardness concentration of 31 to 69 milligrams per liter (expressed as CaCO_3). This concentration is generally considered to indicate "soft" water. Average chlorides concentration of the creek falls in the range of 3.0 to 5.9 milligrams per liter, with an average nitrate concentration of 0.0 to 0.5 milligrams per liter from the headwaters of Country Line to the junction of South Country Line Creek, and 0.5 to 0.9 milligrams per liter from that point downstream. The water quality information also shows that the average color of the streams in the area in which Country Line Creek is located ranges from five to 40 units. This color is that which comes from decomposition of organic material and industrial pollution, and does not include any color associated with sediment. Natural color becomes barely detectable to the human eye at about five units; while weak tea has a color equivalent of about 300 units.

Country Line Creek was sampled by Soil Conservation Service personnel at three locations in March, 1974, for various water quality parameters. Water temperature of those samples averaged 46 degrees Fahrenheit. Total hardness of all the samples averaged 33 milligrams per liter. Nitrate nitrogen averaged .16 milligrams per liter, although one sample showed no nitrogen at all. The average dissolved oxygen level was 11 milligrams per liter and the average pH was 7.5. Average turbidity was 17 Jtu. It should be pointed out that these measurements are indicative of conditions at the time of sampling, and do not necessarily represent average conditions.

Economic Data

The total watershed population is about 6,100 consisting of 5,350 rural and 750 non-rural. There has been a general decline in the population during the period 1960-1968, as there was an out-migration of approximately 400 persons from the watershed. The 1970 census showed that 48.1

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percent of Caswell County's population was made up of minority groups, and although the watershed's percentage of minority people is not available, it would compare favorably with the county average.

The economy of the watershed is featured by a strong dependence on agriculture. Work force estimates, prepared by the North Carolina Employment Security Commission (14) show that Caswell County had a civilian work force estimate of 5,810 in 1970. The work force was employed by the various groups as follows:

Agriculture- - - - -	2,020
Manufacturing- - - - -	1,140
Non-manufacturing (construction, transportation, government, etc.) - - - - -	1,190
Other non-agriculture (domestics, self-employed, and unpaid family workers)- - - - -	1,150

There were about 310 persons unemployed in 1970 for a rate of 5.3 percent. This is an increase compared to the 1969 rate of 2.4 percent and the 1968 rate of 2.9 percent.

The per capita income was \$2,132 in 1970 for Caswell County, as compared to \$3,208 for the state (15). The county's median family income for the same year was \$6,868, as compared to \$7,774 for the state. Many of the lower income families are located on low-income producing family farms.

The United States Department of Commerce showed the number of farms in Caswell County in 1969 as 1,263 (16). This includes part-time and part-retirement farms. Farms average about 132 acres in size with the average value of a farm unit being about \$27,564 (16). The average value of farmland in the watershed is about \$300 per acre.

The number of farms in the county, by economic classes in 1969, were as follows:

Class 1	----- Sales of \$40,000 and over	-----	22
Class 2	----- Sales of \$20,000 -- \$39,999	-----	87
Class 3	----- Sales of \$10,000 -- \$19,999	-----	162
Class 4	----- Sales of \$ 5,000 -- \$ 9,999	-----	285
Class 5	----- Sales of \$ 2,500 -- \$ 4,999	-----	295
Class 6 ^{1/}	----- Sales of \$ 50 -- \$ 2,499	-----	109
Part-Time ^{2/}	----- Sales of \$ 50 -- \$ 2,499	-----	181
Part-Retirement ^{3/}	----- Sales of \$ 50 -- \$ 2,499	-----	122

^{1/} Farm operator under 65 years old who did not work off the farm 100 days or more.

^{2/} Farm operator under 65 years old who worked off the farm more than 100 days.

^{3/} Farm operator 65 years old or older.

Major farm enterprises in the watershed are corn, tobacco, soybeans, small grain, livestock, and dairying. The value of all farm products sold in Caswell County in 1969 amounted to \$9,561,850 (16). The portion of this generated by livestock sales was \$1,709,240 and \$7,673,284 was generated by sales of crops (16). This compares to corresponding sales of \$1,148,689 and \$10,267,970 respectively in 1964 (16). Sales of forestry products in 1969 amounted to \$179,326 (16).

The watershed is served by an adequate network of highways, primary roads, secondary roads, and railroads. U.S. Highway 158, North Carolina Highways 86 and 62, and numerous other paved roads pass through the watershed. The Atlantic and Danville Railroad serves Milton in the northern end of the watershed.

Industry within the watershed is not significant. There are several small industries which employ approximately 500 persons.

Forestry Resources

The major feature of the plant community in this watershed is the forestland. The forest types are 43 percent pine, 40 percent pine-hardwood, 10 percent hardwood-pine, and seven percent hardwood. The principal species are short-leaf pine, Virginia pine, yellow poplar, red cedar, red oak, sweetgum, and hickory. Eighty-seven percent of the area is well-stocked with merchantable tree species. Timber volumes, based on the total forestland acreages, will average 840 board feet of pine and 480 board feet of hardwood per acre. Pulpwood volumes would average 495 cubic feet of pine and 203 cubic feet of hardwood per acre. The sale of forest products from productive managed forests provides income to the landowner and contributes to the general economy when harvested and processed.

The understory in the forested areas of the watershed is dominated primarily by various species of small trees and shrubs. Due to sharp variations in soil type and terrain (slope, aspect, etc.), the dominant understory species are often different even between areas with the same type of dominant overstory. Understory species that are common throughout the forested areas include sweetgum, dogwood, sourwood, blackberry, red cedar, red bud, persimmon, plum, huckleberry, gooseberry, spicewood, strawberry bush, red maple, and sumac. The most frequently dominant species would probably be sweetgum, dogwood, and sourwood.

Important plant communities include all stages in the secondary succession pattern typical in abandoned fields in the piedmont region of southeastern United States. The dominant community types in the different stages are described by Odum (17) as bare field, grassland, grass-shrub, pine forest, and oak-hickory forest climax.

Of the 12,700 acres of the Caswell Wildlife Area located in the watershed 11,710 are in woodland and managed primarily as wildlife area. However, a forester is employed to provide woodland management and commercial cutting is done.

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A 1,400 acre tract of woodland owned by the Boy Scouts of America is managed as a wilderness area and consists of hardwoods on steep slopes, on which no commercial cutting is done.

Approximately 970 acres of woodland are industrially owned. There are no National Forest within the watershed.

Fish and Wildlife Resources

Although there are no Type 1 and Type 7 wetland wildlife habitat (18) in the watershed, waterfowl do use the main stream to a limited degree as a resting area with adjacent trees providing some food and cover. The large areas of upland forests provide some excellent habitat for rabbit, quail, squirrel, deer, and turkey.

A variety of wildlife, including game and non-game species, is found in the watershed area. The big game species present are white-tailed deer and wild turkey, with high populations of both. The primary small game species are bobwhite quail, rabbit, mourning dove, and gray squirrel, with populations ranging from moderate to high. Furbearer populations range from low to moderate and include raccoon, mink, muskrat, opossum, beaver, and both gray and red fox. There is a low waterfowl population, with the wood duck being the primary species. There are many different species of song and other birds, reptiles, amphibians, and small non-game mammals, with populations ranging low to high locally dependent upon the habitat.

Country Line Creek is listed in A Catalog of the Inland Fishing Waters in North Carolina (19) with the lower four miles having an ecological classification (E/C) of catfish-sucker, the middle 12 miles having an E/C of largemouth-pickrel, and the upper 14 miles having an E/C of dace-trickle. Tributary streams were listed as "too small to be of fishing significance."

The Survey and Classification of the Roanoke River and Tributaries, North Carolina (20), reports that the stream has harvestable populations of red-breast sunfish, redbreast pickerel, and channel catfish. Most fishing occurs in the lower 16 miles of stream with the upper reaches and tributaries being limited primarily to sucker gigging in the spring.

The results from a sample station in the dace-trickle portion of the stream and a station in the catfish-sucker portion are given in the above mentioned stream survey report. In the dace-trickle station, redbreast pickerel were found, along with members of the minnow family (such as several species of dace, chubs, and shiner) and members of the perch family (such as several species of darters). In the catfish-sucker section, redbreast sunfish, black crappie, yellow perch, and redbreast pickerel were found, along with members of the minnow family (chubs, shiners, dace, and carp), the perch family (darters), and the sucker family (redhorse suckers and chubsuckers), and the catfish family (channel catfish and madtoms).

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Fish food organisms (macrobenthic) were also sampled at these stations. At the dace-trickle station, the average number of organisms per square foot was 36.5 and average volume of organisms per square foot was 0.95 ml. These figures may be compared to similar figures for dace-trickle streams in the Roanoke Basin, where the average number was 12.9 and the average volume was 0.79 ml. At the catfish-sucker station, the number of organisms per square foot was 7.5 and the average volume was 0.2 ml. The similar figures for all catfish-sucker streams in the basin were 15.8 and 2.72 ml. No sampling was done in the largemouth-pickereel section of Country Line Creek but for this type of stream throughout the basin, the average number of organisms per square foot was 9.1, with an average volume per square foot of 1.41 ml. Of the two reservoirs planned, No. 1 will be on the section of stream classified as dace-trickle and No. 4 will be on a tributary stream listed in the Catalog as being too small to be of fishing significance.

No rare or endangered species have been reported from this watershed area; however, three animal species on the preliminary List of Endangered Plant and Animal Species in North Carolina (21) have ranges which indicate they might possibly be permanent or temporary residents of the watershed area.

A rare salamander, Hemidactylium scutatum, whose range is considered to cover all the piedmont and mountain counties in North Carolina might be present, but there is no record from Caswell County. Although the larval form is aquatic, the adult is terrestrial. The project as planned should have little or no effect on this species if present.

Two fish species, the rare Roanoke Hogsucker (Hypentelium roanokense) and the endangered Bigeye Jumprock (Moxostoma valenciennium), are endemic to the Roanoke River system. Since both are known to make spring spawning runs up tributaries, Country Line Creek might be involved. However, since no channel work is planned and the two structure sites are in the upper reaches of the stream, the project should have little or no effect on these species even if they do utilize Country Line Creek.

Recreational Resources

There is a minimum of water-based recreational facilities within the watershed.

Most of the fishing that is done on Country Line Creek takes place at the few road crossings. Access to the main channel between North Carolina Highway 86 and the Dan River is very difficult, since there are no roads near or parallel the creek in this area. As a result, any fishing done other than at road crossings requires the crossing of private lands.

Hyco Lake, owned by Carolina Power and Light Company and controlled by the Person-Caswell County Lake Authority is located east of the watershed and provides a limited amount of boating and fishing. A 64-acre public recreation area is the only recreational facility provided. The annual recreation attendance has been estimated at 50,000 (22.) The

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headwaters of Kerr Lake are located approximately 50 miles from the proposed recreation site. This reservoir provides most types of water-based recreation but public access is limited to certain areas. Many of the watershed residents live outside the 50-mile radius of this lake. Also many people in the large population centers within 50 miles of the proposed recreation site (Burlington, Greensboro, etc.) live 75 miles or further from Kerr Lake.

Public hunting in the watershed is more readily available as a result of the Caswell Wildlife Management Area being located almost entirely within the watershed. Game hunted in this area includes rabbit, quail, squirrel, dove, deer, and turkey. Much of this 14,000-acre area is available to the public on a managed and controlled basis. Annual attendance at this facility averages about 6,500 (22). Hunting opportunities for private landowners who own forested land are also good. There are several small hunting clubs in the watershed as well as a large hunting club at Hyco Lake with an annual attendance of 2,700 (22), and a wildlife access area at Milton.

A four acre pond near Red House is open to public fishing. Two small ponds are maintained by the North Carolina Wildlife Resources Commission and provide free fishing to the public. These ponds provide excellent bass and bluegill fishing through intensive management by the Commission.

No other public recreational facilities of any type are available within the watershed. A private boy scout camp of 1,400 acres is located within the project area.

Archaeological and Historical Values and Unique Scenic Areas

Several sites in Caswell County are identified in the National Register. These sites include Rose Hill and Moore House in the vicinity of Locust Hill; Milton Historic District and Milton State Bank in Milton and the Caswell County Courthouse and Yanceyville Historic District in Yanceyville. Yanceyville and Locust Hill are located on the northwestern rim of Country Line Creek Watershed and Milton is located at the confluence of Country Line Creek and Dan River.

Two additional sites located during the planning of the project have been determined by the Department of the Interior as being eligible for inclusion in the Register (See Effects Section page 44.) One of these is an archaeological site (Csl2) located in the recreational development area of structure No. 4. The other is Womack's Mill located in the permanent pool of Structure No. 1.

Soil, Water, and Plant Management Status

To date, there have been about 240 soil and water conservation plans prepared on farms within the watershed. These plans cover about 30,000 acres and represent 42 percent of the farms and acreage.

Adequate conservation treatment has been applied to 4,440 acres of cropland thus far. The Soil Conservation Service has estimated that there are

13,930 acres of eroding cropland in the watershed, of which 4,258 acres have been treated.

Most of the forestland in the watershed is under a very limited or no management program. There have been very few conservation practices applied to forestland thus far. Much of the forested areas now in the watershed were once cleared and used for growing cotton. However, severe erosion during the 1920's and 1930's forced much land to be abandoned from production. The present poor hydrologic conditions of the forestland stems directly from the past agricultural practices and the loss of valuable topsoil due to erosion. Even today, farmers are forced to employ factors of production inefficiently on the erosion-prone cropland. This results from having to repair erosion damages to the fields, difficulty in cultivating fields with very shallow or no topsoil, etc. A description of the planned land treatment measures and their purposes is included on pages 29-32.

The Caswell Wildlife Management Area is the only area of managed resources within the watershed. The privately owned ponds are used primarily for private recreation, livestock water, and irrigation.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and Water Management

Approximately 70 percent of the cropland in the watershed needs some type of treatment to be considered as adequately treated. The most seriously needed conservation practices include conservation cropping systems, contour farming, terracing, crop residue use, and field border planting. Some of the steeper areas which are now being used for crops need to be converted to less intensive uses, such as trees or pasture. There are also many areas that are used for row crops year after year which need conservation cropping systems that allow grass or other close-growing crops to be grown part of the time. The hydrologic condition of the cropland varies from fair to poor.

The hydrologic condition of the forestland is generally poor, and for this reason, excessive runoff is produced from the forestlands. The poor condition is due, in part, to the lack of a good humus layer to retard runoff.

A major problem in improving the forest resource is that of motivating the small forest landowner to invest in forest improvement practices which will not bring him a financial return for many years. However planned management practices can provide forest landowners with periodic returns from thinnings and improvement cuts. The costs with regenerating a new forest can be minimal if properly planned and executed at this time of final harvest.

The 1968 fire loss index goal was 0.23 percent. The average burn for 1965-1969 was 0.008 percent. This burn record for the watershed shows adequate protection. The continued efficiency and effectiveness of the North Carolina Division of Forest Resources will be adequate to take care of any increase in hazard to risk.

Other land management problems not related directly to physical characteristics of the watershed also occur. It is difficult for the soil conservationist to encourage needed land treatment measures when absentee landowners are involved. This type landowner is often located at a distance and does not recognize the problems on his land. Another complicating factor is the speculative landowner whose main objective is to hold the land for development or higher prices and who is not really interested in maintaining the productivity of his land. The average age of Caswell County farmers is 52 years (16). At this age, many farmers are not willing to make investments in land treatment measures, whose full benefits are realized only over a number of years. Other problems involved in getting land treatment installed include small fields, or farms, farmers working off the farm thus lacking time to do the work, and disinterest among some landowners.

Floodwater Damages

Downstream from the proposed structures, 1,920 acres are inundated by the 100-year frequency storm. However, flooding is so frequent that the cumulative average acreage flooded annually is about 3,182. The one-year and six-month floods account for more than half this acreage and cause a large share of the average annual damage.

Approximately 57 percent of the flooding occurs during the growing season. This flooding reduces production on the open land below structures which is used for crops. This threat of flooding also prevents a more intensive use of the land along the streams for crops, causing a heavy cropping stress to be placed on open upland.

Annual floodwater damage to crops and pasture has been estimated to be \$12,190. Damage to other agricultural property (fences, buildings, farm roads) amounts to \$4,710 annually. Other non-agricultural property (roads, bridges, etc.) suffers flood damages estimated at \$1,000 annually.

Erosion Damages

The total erosion from all sources in the watershed is 226,600 tons annually, of which 178,700 tons are derived from cropland and 47,900 tons come from roads and other sources. An average annual erosion rate from all types of cropland would be 11.0 tons per acre annually, while the overall erosion rate from the watershed is 2.5 tons per acre per year.

Critical sediment source areas are limited to roadbanks, unpaved roads, and gullies. These areas produce 2,075 tons of sediment annually resulting in a rate of 31 tons per acre per year.

Streambank erosion in the watershed is not a serious problem. Aggradation is occurring along many reaches as a result of sediment delivered into the channels.

Forest improvement practices forest harvesting and regeneration, if properly planned and executed, cause very limited erosion for only a short period of time.

Sheet erosion from cropland is the most significant source of sediment delivered downstream and is the major cause of channel fill. A high percent of sediment produced by sheet erosion is delivered to the channels through the extensive drainage network on the upland soils and the relatively steep topography. Sheet erosion from cropland has been very extensive in the past. During the 1920's and 1930's, large amounts of land were cleared and used for growing cotton. There was little concern at this time for using good conservation measures to control erosion. As a result, much of the land lost entire soil profiles. Numerous upland ridges, previously cultivated, now show almost no profile, with weathered rock lying very close to the surface. The wide, extensive flood plains along the main channels were covered with the relatively coarse material delivered from the uplands. This deposition has caused much of the flood plain to revert to trees and brush. In almost all the flood plains, a buried soil can be found within four feet of the surface. This was the original soil before the period of accelerated erosion and deposition of the 1920's and 1930's.

The estimated average annual damages to cropland from erosion are included in the \$10,335 average annual damages from overbank deposition and swamping. Other minor erosion damages of \$675 annually occur as flood plain scour and streambank erosion.

Sediment Damages

Damage to crop and pasture land from infertile deposition occurs at scattered locations throughout the watershed. These depositions are occurring at a slow enough rate, at present, that the material can be mixed and worked in with the existing fertile alluvial soil. This results in only moderate adverse effects to the production of the crop and pasture land. Damages to idle bottom land from infertile deposition may appear to be greater than damage to cropland, due to the lack of this mixing action. Where significant infertile deposition damages do occur, it is usually caused by debris jams in the channels.

Swamping occurs along some 265 acres of low-lying areas in the flood plain. This swamping has been caused by a raised water table caused by accelerated erosion and sedimentation which reached its peak in the 1920's. Channel fill has occurred along much of the streams and natural levees have been formed along the channel banks in those areas subject to flooding.

In addition to land damages resulting from infertile deposition and channel fill, sediment deposition also affects the Dan River and Kerr Lake Reservoir. It has been estimated by the Soil Conservation Service that 81,725 tons of sediment are delivered from the watershed into the Dan River annually. Of this amount, approximately 16,345 tons per year are deposited in Kerr Lake Reservoir. This deposition results in a loss of storage capacity as well as a decrease in recreational and aesthetic values of the lake.

Sediment has also been shown to be the major carrier of plant nutrients, which create eutrophic conditions and nuisance algal blooms in lakes (24). Dangerous farm chemicals, such as insecticides, are likewise sediment associated (25). Thus, sediment getting into rivers and lakes has a potential

Resource Problems

of causing water quality problems as well as the more common problems (infertile deposition, channel fill, etc.).

The total average annual damages from sediment amount to \$33,435. Of this amount, overbank deposition amounts to \$5,715, swamping damages are \$4,620, and damages to reservoirs are \$23,100.

Drainage

Although poor drainage is a very minor problem in the watershed, there are some areas along the flood plains that suffer from this problem. This lack of drainage has been brought about mainly as a result of channel fill and swamping conditions. This poorly drained land causes farmers to employ factors of production, such as land, labor, and capital, inefficiently on it. Examples of inefficient production include late planting, late harvesting etc.

Irrigation

Irrigation is sometimes needed on the high value crops in the watershed. Most of the water needed for this purpose can be obtained from farm ponds. It is anticipated that there will be a sufficient supply of water to meet projected irrigation needs in the future.

Municipal and Industrial Water

The main problem of this type in the watershed is the lack of an adequate, reliable source of water to meet both present and projected future needs. The town of Yanceyville is presently obtaining its water from a small impoundment on a tributary of Country Line Creek. The supply from this reservoir is depleted almost every year, causing restriction of water use by the citizens of Yanceyville. The town has found it necessary to rent an irrigation pump to replenish their water supply from Country Line Creek. This arrangement thus far has not been satisfactory.

The town desires to establish a plentiful supply of water through surface storage. A consulting firm hired by the town has previously determined that wells are impractical to meet the town's needs. These needs require storage of about one billion gallons of water by the year 2000.

The lack of a suitable water supply has severely limited the growth of industry in Caswell County, especially around Yanceyville.

Recreation

The watershed area is very limited in regard to recreation, especially water-based recreation. All of the watershed is in the piedmont area and according to the North Carolina Outdoor Recreation Plan (26), the piedmont has the greatest remaining needs for acquisition and development of water-oriented recreation.

Also, there are no other types of recreation (bowling, city parks, etc) located within Yanceyville or the watershed area. Only Caswell Wildlife Management Area is listed in the Caswell County Inventory of Recreational Developments (22) as an existing recreation resource.

The present population within a 50-mile radius of the watershed is 750,000. Urban centers located within this 50-mile zone include Greensboro, Burlington, Reidsville, Graham, and Roxboro in North Carolina, and Danville and Martinsville in Virginia. Water quality of the streams where the recreational development will be is high enough to prevent any problems. All the incoming streams are already class "B". This classification designates the water as being suitable for recreational use and other uses requiring water of lower quality. There will probably be some temporary muddying of the water in the reservoir after a heavy rain.

Fish and Wildlife

The main problem affecting the fishery resource within the watershed is sediment. The upper reaches of Country Line Creek, especially the stream bottom, are covered by a layer of sand. This sand bottom is very non-conducive to aquatic plant growth and does not provide suitable habitat for lower order organisms in the "food web". Also little or no flow in these reaches during dry periods makes them poor fish habitat areas.

No major problems occur to upland wildlife within the watershed. An excellent wildlife management program exists in the Caswell Wildlife Management Area. More wildlife management practices (wildlife and cover plantings, etc.) on private land would be beneficial however.

There are no serious water quality problems in the watershed at the present time. Yanceyville has the only sewage treatment plant in the watershed. However, the effluent from this plant is discharged downstream from both of the planned structures and will not be a problem.

Any other pollutants within the streams are derived from agriculture. With the large amount of sediment delivered into the channels every year, there is a tremendous potential for sediment associated pollutants to enter the watershed streams. Sediment has been shown to be a major carrier of phosphorous, nitrogen, insecticides, etc. (24 (25)).

Economic and Social

One of the greatest problems of this type is the large number of people who have to leave the watershed for off-farm employment opportunities. In fact, it has been estimated that over 50 percent of the residents of Caswell County work outside the county. This results from the lack of industrial development around Yanceyville and the watershed area in general.

The lack of non-farm employment opportunities and the decrease in farming intensity has led to an out-migration from Caswell County in the past 20 years. For example, in the period 1950-1960, the county had a net out-migration of 23.7 percent (15). From 1965-1970, the net out-migration averaged 8.4 percent (15). Employment opportunities within the county and the watershed are needed to help curb this trend.

Low income is another problem facing watershed residents. Per capita income for Caswell County in 1970 was \$2,132, as compared to \$3,208 for the state, and \$3,910 for the nation (22). The median family income in Caswell County is \$6,868, as compared to \$7,774 for the state. This implies that half of the families in the watershed had incomes of less than \$6,868. In addition, the income, per agricultural worker, in Caswell County for 1970 was \$6,550, as compared to an average of \$10,226 for the state (15).

Associated with the low-income problem is a high unemployment rate among the minority groups of the county. Approximately 48 percent of the county is in minority groups (27). About 9.9 percent of the minority working force is unemployed. (This includes a 14.1 percent unemployment rate among minority women.)

Agricultural employment decreased considerably during the period 1963 - 1971. In 1963, there were 3,490 agricultural workers in Caswell County, but by 1970, this figure had declined to 1,990 workers. Much of the out-migration from the county has been from rural areas.

From the standpoint of education, Caswell County again ranks below the state average. The median years of school completed by persons 25 years or older in Caswell County is 7.5, compared to 8.9 for the state. A curb in the out-migration from the county is necessary for the establishment and maintenance of an improved school system.

PROJECTS OF OTHER AGENCIES

Kerr Lake, developed and operated by the United States Army, Corps of Engineers, is located 32 miles downstream from the watershed on the Dan River. This 48,900-acre lake was developed for hydroelectric power generation and recreation. It will receive a sediment reduction benefit if the Country Line Creek Watershed project is installed. The Soil Conservation Service has estimated that a decrease of 11,275 tons of sediment getting into the lake annually would result from the project and that this benefit in monetary terms would be worth \$15,900. There are no other known or planned water resource projects that would affect or be affected by the planned project.

PROJECT FORMULATION

Numerous contacts have been made with various agencies throughout the project formulation, either for gathering information or conducting necessary business connected with the project.

Before the application for P. L. 566 assistance had been made, the sponsors had recognized the need for obtaining a sound prediction of the area's future needs in a municipal and industrial water supply site. To do this, a private engineering firm was retained to make this estimate of future needs and also recommended some further considerations for the structures.

Soon after the application for assistance was received by the State Soil and Water Conservation Commission in April, 1969, the North Carolina Wildlife Resources Commission was contacted in regard to including fish and wildlife features in the planned structures.

Fish and wildlife investigation in the watershed are made jointly by biologists from the North Carolina Wildlife Resources Commission, United States Fish and Wildlife Service, and the Soil Conservation Service, to determine the potential developments, benefits, and damages to fish and wildlife caused by the project.

Several meetings between the sponsors and the Soil Conservation Service were held during the early project formulation period. Other watershed residents were present at some of the meetings and contributed to the planning. The district conservationist at Yanceyville also contacted the local people occasionally for land values, land treatment information, etc.

The United States Forest Service, in co-operation with the North Carolina Division of Forest Resources and the Soil Conservation Service, made investigations to determine the forest conservation measures needed in the watershed and to formulate the forestry phase of the land treatment program. The goals for forestry land treatment were set so they could reasonably be accomplished during the project installation period.

Numerous meetings were held and contacts made between the Soil Conservation Service, the sponsors, and the North Carolina Wildlife Resources Commission in connection with 630 acres of state-owned land in the Caswell Wildlife Management Area that will be involved with structure No. 4. Originally, the Commission had agreed to donate the 630 acres of the structures in return for the right to use all the reservoir land (1,626 acres) as a managed hunting area. However, due to the legal restraints, this method was not allowable. Several other alternatives were explored by the sponsors and the North Carolina Wildlife Resources Commission before reaching an acceptable agreement on the state-owned land. This arrangement came after the Commission had checked certain matters of law with the Bureau of Sport Fisheries and Wildlife. The agreement provided that the sponsors would buy the 630 acres outright or purchase an additional 630 acres of other land in the area of the game lands to exchange for fee title ownership of the 630 acres in question.

Contacts were also made with the United States Department of the Interior, Bureau of Outdoor Recreation, and the North Carolina Department of Cultural Resources, Division of Archives and History, for possible locations of archaeological, historical, or scientific resources. Both of these agencies returned negative replies on any existing resources, although both did recommend further contacts with other agencies and personnel.

Formulation

The North Carolina Department of Transportation and Highway Safety provided suggestions on dealing with required road modifications involved with the construction of the planned structures, as well as cost estimates for making the modification.

In 1972 the Soil Conservation Service revised criteria for structures having drainage areas of over 10 square miles. Both of the planned structures on Country Line Creek fall into this category. After many technical reviews, structure No. 1 was redesigned in January, 1973. A new geologic investigation was made and the report was presented to the sponsors in April, 1973. The Soil Conservation Service also requested that the sponsors provide concurrence that the sites could hold water.

The sponsors retained a consulting engineering firm to review the geologic investigation report of the Soil Conservation Service. In July, 1973, the sponsors received a reply to the effect that the firm concurred in the Soil Conservation Service's findings and in the ability of the sites to hold water.

In September, 1973, the Soil Conservation Service met with the sponsors to review revised cost estimates of the structures. (These revised costs resulted from a redesign of the structures to modify emergency spillway outlets). Also, the Soil Conservation Service conveyed to the sponsors the need to rewrite the work plan and to prepare an environmental statement on the project.

The Soil Conservation Service met with the sponsors again in December of 1973, to further talk about the watershed project and to discuss the need for a re-evaluation of some of the project benefits. Also discussed was the need for the sponsors to provide a letter stating their means for financing their share of the project costs.

The sponsors again contacted their consulting engineering firm on the re-evaluation of the municipal and industrial water supply. In March, 1974, the sponsors reconfirmed the value of the water stored and forwarded this information to the Soil Conservation Service. At this time, the Soil Conservation Service also received a letter from the sponsors outlining their method for financing the local share of the project costs.

Country Line Creek Watershed is located within the North Central Piedmont Resource Conservation and Development Project Area. The purpose of the RC&D project is to maintain and enhance land and water resources through various project measures.

Installation of the project will contribute directly toward accomplishing the following objectives of the North Central Piedmont Resource Conservation and Development Project as stated in the RC&D Project Plan:

1. Optimum development of water resources to meet urgent needs and to develop maximum potentials for economic growth.
2. The orderly adjustment of land uses for present and future needs; i.e.; agricultural, rural, recreational . . . purposes.
3. Provide new and improved present job opportunities and incomes by development of natural resources for agricultural development, expansion of industry, recreation, and tourism.
4. Accelerate conservation planning and land treatment. Encourage planning and conservation measures for all lands.
5. Encourage and assist in development of parks, and outdoor recreational facilities.

Objectives

The broad objectives of the sponsors in formulating the project plan were to improve the productivity of land, reduce flood damages, to secure an adequate municipal and industrial water supply for future needs, and to develop a water-based recreational facility accessible to the public.

The goal for improvement of productivity is to apply accelerated land treatment to 2,599 acres of cropland, 2,163 acres of pastureland and hayland, and 4,255 acres of forestland. It was determined this goal could be accomplished by accelerating the existing conservation plans and by developing an additional 89 plans. Also about 65 additional land-owners will need to enter into co-operative agreements with soil and water conservation districts for assistance in installing land treatment measures.

The level of flood prevention to a given area of flood plain below structures will vary according to distance from the structures. The multiple-purpose structures are designed to retard runoff from storms up to the 100-year, 10-day event.

The objective of the sponsors in providing recreation was to develop the most practical, economical facility to serve the surrounding population within a 50-mile radius (750,000) and the expected future increase in population were considered. The recreational facility will have a designed capacity of 1,625 visitors per day. This includes the following activity capacities: camping -- 480; boating -- 272; fishing -- 150; and picnicking -- 725. (See PROJECT BENEFITS for relationship of projected daily and annual usage.)

Formulation

The goal of the sponsors was to provide municipal and industrial water supply adequate to meet projected needs for the life of the project. A study by a consulting firm, retained by the sponsors, showed that this need would be met by storage of about 3,000 acre-feet of water for this purpose.

Environmental Considerations

Consideration was given to the water quality of the streams at the proposed structure site locations. The classification of Country Line Creek at the proposed location of structure No. 1 is now "A-II," which designates it as being suitable for water supply. South Country Line Creek at the proposed location of structure No. 4 is now class "B," which designates it as being suitable for recreation, including body contact.

Consideration was given to potential adverse effects on fishery resources resulting from construction of the two structures. However, only one of the stream sections involved is listed in the Catalog of Inland Fishing Waters In North Carolina. (19).

This section includes that part of Country Line Creek which will be inundated by Structure No. 1. The classification of this section (dace-trickle) has the lowest fishery value of all the classifications listed in the Catalog. It was determined that the construction of structure No. 1 would greatly increase the fishery value of this stream section. The effect of Structure No. 4 on the other stream sections would be similar.

The construction of structure No. 1 and structure No. 4 will cause displacement of nine families and six farm operations. Relocation assistance will be provided by the sponsors to the persons affected. The Uniform Relocation and Real Properties Acquisition Act insures that all displaced persons will be justly compensated and that no one will suffer an economic loss.

Alternatives

Accelerated Land Treatment Program - This alternative would involve an accelerated conservation program on 2,599 acres of cropland, 2,163 acres of pastureland, 4,255 acres of forestland, and 67 acres of critically eroding areas. Technical assistance for applying these measures would be provided by the Soil Conservation Service through the Caswell County and Rockingham County Soil and Water Conservation Districts and the United States Forest Service.

The accelerated land treatment program would be the same as the land treatment program of the planned project. Some of the benefits of the planned project could be realized with this program and no structural measures. For

example, the reduction of total erosion in the watershed by 153,140 tons annually (68 percent) would still be realized. Included in this would be an 84 percent reduction in critical area erosion.

Associated with the decreased erosion would be decreased sediment and sediment associated pollutants. Fish in Country Line Creek, especially the lower reaches, would benefit from decreased sediment, although the benefits would not be nearly as great as with the "trap effect" of the structures. The structures have been predicted to trap 60,250 tons of sediment per year.

Upland wildlife would benefit from the 640 acres of wildlife habitat development involved with the land treatment program. Any benefits occurring to waterfowl as a result of the structures would be foregone however.

While helping to a limited degree in reducing flooding from the frequent, less intensive storm, land treatment would have little effect in reducing damages from heavy, extended rainfalls. The estimated average annual flood damage reduction benefits from land treatment are \$6,850, but \$52,330 in average annual damages would continue with this alternative.

Adverse environmental impacts caused by the project such as the loss of eight miles of stream, 1,100 acres of wildlife habitat, displacements in securing land rights, and temporary increase in sedimentation during construction would be avoided. Future productivity of the land on which conservation measures are applied would be assured.

Favorable environmental effects of the project, including the creation of a reliable municipal and industrial water supply, and the stimulus it would provide to Yanceyville and Caswell County; the creation of 1,030 acres of fishery habitat; supplying 135,000 visitor-days of recreation annually; providing 80 man-years of employment during construction and nine jobs over the project life; and the improvement in water quality provided by the structures would be foregone. The total average annual net monetary benefits that would be foregone with this alternative would amount to \$79,660.

Alternate physical arrangements of resources - This alternative would include any structure system different from the planned project, of course, it would be impractical to discuss all possible systems. No specific alternate sites were analyzed for a detailed engineering cost estimate although in the early project formulation, a system of five structures was considered before selecting the two planned structures. The amount of storage required for the municipal and industrial water supply needs was determined by a consulting engineering firm. Thus, whether the water is stored in one structure or in several structures, the volume has been fixed. The topography of this watershed is such that storage volume can be built up much more economically at a single structure site location than can the same volume be stored at two or more locations. Another factor to consider is the reliability of flow in the stream. Observation of the project map shows that there are no structure site locations near

Formulation

Yanceyville (except on Country Line Creek) which have a large enough drainage area to provide a reliable water supply during drought periods. If any of the smaller tributaries were used, the storage required for the same reliability would have to be much greater than the storage required for the larger drainage area of the planned structure. Also, the farther the site from Yanceyville, the more costs there would be in pipes and water conveyance systems. Structure No. 4 could possibly be used as an alternate municipal and industrial water supply site, but its physical characteristics lend it as an excellent recreational impoundment. Also it is considerably farther from Yanceyville than Structure No. 1 (see project map).

The site of structure No. 4 is especially well adapted to recreational use since it is located at the junction of four tributaries (see project map) and the cost per surface acre of water created at this location is less than it would be at another site. A smaller recreation development could be built here or at an alternate location, but in view of the relatively large population within a 50-mile radius (725,000) and the projected population increases, the size of the planned lake is considered justified. The principal of one large lake being much cheaper than two half its size also holds true in this case.

The recreational and municipal and industrial benefits obtained by alternate structure sites (assuming the same amount and reliability of storage) would be the same as the planned project (\$256,300 annually). However, the two sites selected represent the most practical and economic way to achieve the objectives stated by the sponsors.

Other Considerations included the possibility of obtaining the desired municipal and industrial water from ground water supplies; the possibility of buying or obtaining the water elsewhere and pumping it to Yanceyville and the possibility of reducing flood and erosion damages through alternate methods.

The development of a public water supply from the ground water resources in the watershed would be impractical for two basic reasons; the underlying rocks are relatively poor aquifers, and, surface water is abundant and can be more economically developed.

In general, data obtained in the watershed indicated that the rock types (gneiss, sericite schist, greenstone schist, diorite) are relatively poor aquifers due to the thinness of the weathered zone above solid rock. The .

weathered zone does not form an adequate reservoir to collect and store the rainfall.

Yanceyville, the county seat of Caswell County, changed from a ground water municipal source to a surface water source in 1952 in order to meet their water supply needs. Wells used previous to 1952 had rather low yields and relatively large drawdowns and were considered unsatisfactory.

The most desirable type of well to use depends on the underlying rock formations of the specific area. The reliability of wells is also extremely variable from place to place. A high cost would be involved in geologic investigations and in attempting to develop a suitable water supply from a well system.

A private consulting firm hired by the sponsors also determined that the project water needs could not be met by ground water supplies.

It is possible for a water supply that would meet present needs to be taken from Country Line Creek either through a direct water intake system or a weir structure. Published water records (28) show that Country Line Creek at the planned structure location has an average flow of about 48 cubic feet per second. At this flow, the total yields per day would be about 30 million gallons. But the 10-year, seven-day low flow at this location is only two cubic feet per second (28), which is about four percent of average. The 10-year, 90-day low flow is about 15 cubic feet per second, slightly over 30 percent of normal (28). These low flows alone would not supply the projected needs, and therefore, supplemental storage in a structure is required. Adequate flow does exist in the Dan River to provide the water supply to the watershed from a direct water intake or a weir structure (28). If this were possible, however, the cost of the pipe alone to take the required amount of water from the Dan River to Yanceyville would exceed 10 million dollars. This does not take into account the cost of pumps, land rights, easements, or the operation and maintenance of such a system. A similar system to Hyco Lake, assuming that water could be purchased, would cost at least as much as a system on the Dan River.

Channel work, in conjunction with the planned structures, was originally considered as a possible way to reduce flood damages. However, an analysis of the proposed channel system indicated that in order to derive enough benefits to justify the channel work, new land would have to be brought into agricultural production. The proposed channel work was therefore eliminated.

Formulation

Federal crop insurance is available in Caswell County only for tobacco. But tobacco is normally planted on the better, more well protected cropland. Corn, soybeans, and small grain are the crops most commonly grown on the areas susceptible to flood damage and since the insurance program is not applicable on these crops, it offers no relief from damages suffered. There are no other federal or state programs at this time which offer alternate uses of the entire flood plain in the watershed. The recently implemented Rural Environmental Conservation Program offers some possibilities for alternate uses on an individual basis.

No Project - The alternative of no action would avoid the elimination of 1,100 acres of wildlife habitat to be converted to permanent water, dams, spillways, and other uses in the two structures. However, the steep cropland would continue to be used for row crops. The sediment and erosion problems would continue to worsen, as well as flooding problems resulting from channel fill. The no project alternative would forego the 135,000 annual visitor-days of recreation to be created by the two planned structures as well as the stimulation to industrial growth, due to the municipal and industrial water supply. Beneficial effects occurring to the fishery resources (low flow augmentation, sediment reduction, etc.) and to upland wildlife (food plantings and habitat management) would be foregone. In addition, the out-migration of people from the county to urban centers would probably continue and the growth of Yanceyville would still be restricted as it has in the past. The total net benefits that would be foregone with this alternative amount to about \$86,510.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment

This part of the planned project involves the going conservation program combined with an accelerated land treatment program on 2,599 acres of cropland, 2,163 acres of pastureland and hayland, and 4,255 acres of forestland. These measures are necessary to conserve, develop, and improve agricultural land within the watershed, and to assure the realization of benefits used in the justification of structural measures. Vegetative conservation measures will include conservation cropping systems, minimum tillage, crop residue use, field border plantings, contour farming, and stripcropping. Grassed waterways, terraces, and tile or open ditch drainage will constitute the mechanical conservation measures. Conservation treatment on the forested areas will consist of tree planting for critical area stabilization, tree planting for watershed protection, and stand improvement measures.

Improvement

Technical assistance for planning and installing land treatment measures will be provided by the Soil Conservation Service through the Caswell County and Rockingham County Soil and Water Conservation Districts. The North Carolina Division of Forest Resources will provide assistance in installing all forestry measures.

Land treatment on both the cropland and forestland may involve a combination of several practices to obtain an "adequate" level of treatment. Therefore, a particular acre may be included more than once in the following description of individual practices, and the summation of the acres to be treated by individual practices will exceed the actual acres to be treated. Land adequately treated is defined as land used within its capability on which the conservation practices that are essential to its protection and planned improvement have been applied.

Approximately 67 acres of critically eroding areas will be treated. The National Handbook of Conservation Practices (30) defines critical area planting as the planting of trees, shrubs, vines, grasses, or legumes on severe sediment producing, highly erodible, or existing badly eroded areas, such as gullies, cuts, fills, etc. Of these 67 acres, 30 will be planted to trees and 37 will be planted to grasses and legumes. Some of the critical areas (27 acres) are located above the planned reservoirs. The sponsors are responsible for treating 75 percent (20 acres) of the critical areas above the reservoirs before the advertisement of bids for their construction.

The planned project includes the installation of conservation cropping systems on 2,213 acres. The Handbook (30) defines the practice as the growing of crops in rotation systems in combination with needed cultural and management techniques.

Crop residue use (30) will be initiated on 4,329 acres for the purpose of adding organic matter and improving growing conditions in the soil. This measure normally involves the plowing of leaves, stalks, and other plant remains back into the soil after the crop has been harvested.

Minimum tillage (30) incorporates the use of chemicals and limited cultural operations to keep the disturbance of the soil to a minimum. Use of this measure is planned on 1,029 acres.

A total of 25,650 linear feet of field border plantings (30) is planned for the watershed. The field border provides a cover around the edges of planted fields to help prevent erosion.

Stripcropping (30) is another practice used to reduce soil erosion and control water and involves the growing of crops in alternate bands of grass or a close-growing crop and a row crop or the use of alternate bands of fallow (bare field) and a close-growing crop. The plans for this project include 899 acres of stripcropping.

Improvement

Adequate treatment of pastureland and hayland (30) involves the adoption of a sound management and improvement program such as proper fertilization and liming, brush control, proper timing of harvesting, etc., on already existing pastureland and hayland. Approximately 2,163 acres of pastureland and hayland will be adequately treated during the operation period. New pastureland and hayland will be established on 943 acres.

To be used on 5,305 acres, contour farming (30) is one of the most beneficial mechanical conservation practices to be applied to sloping cropland. In this practice, all cultural operations and planting are done on the contour.

Terrace systems usually used in conjunction with contour farming, are sometimes needed on sloping cropland to intercept runoff water and to transport it off the field at a non-erosive velocity. The goal for this project is installation of 92,320 linear feet of terrace systems.

The diversion is very similar to a terrace except the location and purpose are different (30). Its purpose is to divert undesirable or excess water from one area to another, where it can be used or disposed of safely. For this watershed, 85,006 linear feet of diversion are planned for installation.

Grassed waterways (30) are used as outlets for terrace systems or other places where runoff tends to accumulate. A total of 167 acres of waterways will be installed.

Approximately 810 linear feet of drainage mains and laterals and 810 linear feet of field ditches will be installed. Open drains consist of graded ditches for collecting excess water within a field (30). Some of the ditches will serve to lower the water table on areas having drainage problems. Other ditches will serve as outlets for subsurface drains and to convey floodwater from the fields.

Land smoothing (30) involves the removal of surface irregularities, such as depressions, mounds, old terraces, and turn rows by use of special equipment. Smoothing of 130 acres in the watershed is planned.

The Soil Conservation Service has predicted that 5,064 acres of cropland and 814 acres of pastureland and hayland will receive partial treatment. This will be in addition to the acres of crop and pasture land described previously which will receive adequate treatment. Partially treated land has had one or more conservation measures applied to it, but it still needs other measures to be fully and adequately treated.

The forestry phase of the land treatment program consists of the following measures:

- (a) - Tree Planting - Critical Area Stabilization (30 acres)
- (b) - Tree Planting - Watershed Protection (700 acres)

(c) - Stand Improvement Measures (3,525 acres)

The forest management program is aimed at meeting watershed needs and objectives. The forestlands will be developed to fulfill timber, wildlife, and recreation needs to the extent that such management is compatible with the overall watershed program. Hardwoods will be maintained on hardwood sites and pine-hardwood mixtures will be encouraged on pine lands. A balance will be maintained between foodbearing, den, and potential timber trees. Any problems arising from urban development taking place in the forested part of the watershed will be alleviated through the co-ordinated effort of the watershed forester and planning commission, land developers, or the particular organization involved.

A total of 640 acres of privately owned land will be developed for the improvement or perservation of given wildlife habitat types. Wildlife management on this acreage represents either a primary or secondary land use on which a plan will be developed outlining the types of management by species. Wildlife development will include installation of 11 ponds, pits or reservoirs.

This land treatment phase of this project will be carried out largely through soil and water conservation plans on individual farm units. The soil and water conservation plan (31) is a document which makes specific plans concerning land use and conservation measures to be intalled on a particular farm. The plan is made by the landowner or operator with technical guidance and advice provided by the Soil Conservation Servide. It is estimated that conservation plans will be developed for an additional 89 units during the project installation period, and that 65 additional landowners will enter into co-operative agreements with soil and water conservation districts for assistance in installing land treatment measures. Revisions of 26 existing conservation plans are anticipated.

Structural Measures

Structural works of improvement to be installed will consist of two multiple-purpose reservoirs. The Caswell County Board of Commissioners will be responsible for the installation of structure No. 4; and the Yanceyville Sanitary District and Caswell County Board of Commissioners will have this responsibility for structure No. 1 (see project map). All items of construction, except public road modifications, will be performed under contracts let, administered, and financed by these organizations. Necessary public road modifications will be made by the North Carolina Department of Transportation and Highway Safety.

Improvement

The multiple-purpose structure (30) has storage capacity for floodwater, expected sediment accumulation, and one or more other beneficial uses, such as recreation (see Figure 2). The storage capacity allotted to sediment is that which is expected to accumulate in the structure over a 100-year period.

All applicable state health laws and regulations will be complied with both in design and installation and in operation and maintenance.

The storage allotted to floodwater depends on the size of the structure's drainage area and its classification. (The structure's classification is made according to the hazards that would result if the structure failed.) Storage capacity for the other uses of a multiple-purpose structure (e.g. recreation) is determined according to local needs and physical constraints of the structure site.

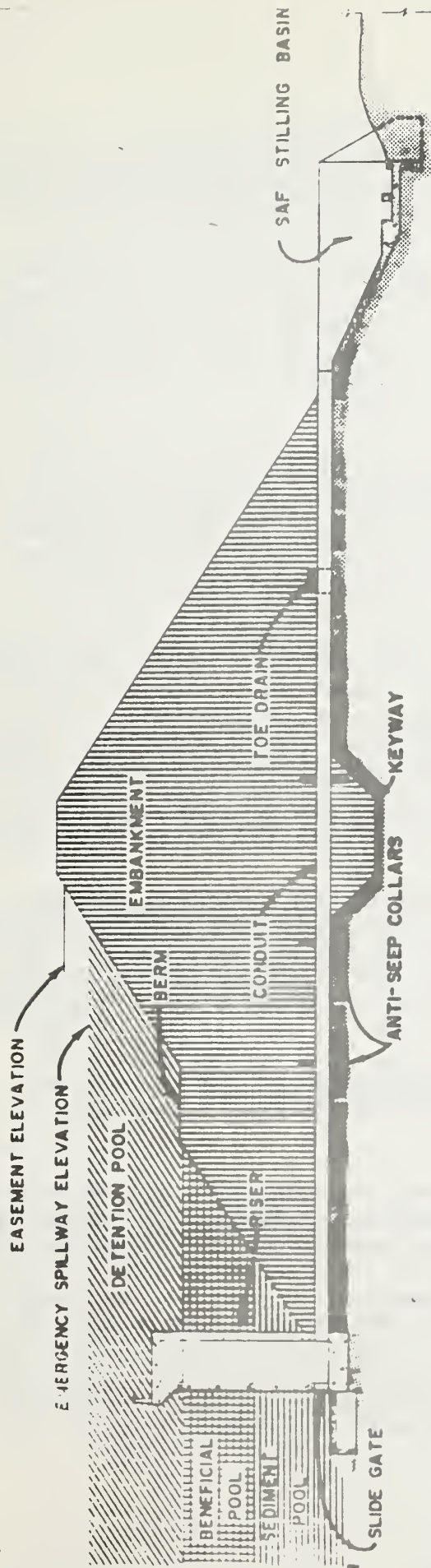
Multiple-purpose structure No. 1 (see project map), to be located on Country Line Creek, will have allotted storage of municipal and industrial water, in addition to its floodwater and sediment storage. The compacted earthfill dam will be 70.5 feet high. A 5.5-foot x 5.5-foot concrete monolithic box through the dam will empty into an energy dissipator to prevent stream scour. A reinforced concrete riser will set the elevation of the permanent pool at 483.5 feet mean sea level. At this level the structure will have 2,210 acre feet of storage, and 3,190 acre-feet of municipal and industrial water storage. A layer of about 15 feet of alluvial fill over the centerline of the structure will produce a yielding foundation for the principal spillway.

The emergency spillway will be excavated so that it will be located in rock. It will likely be necessary to do some "dental grouting" in the rock of the emergency spillway to insure its stability. The crest elevation of the emergency spillway will be at 500.5 feet mean sea level, enabling the structure to temporarily store 9,162 acre-feet of floodwater. It will be designed for a one percent chance of use.

The upstream face of the dam will be riprapped from an elevation two feet below the permanent pool to four feet above, to protect against damage from wave action. The structure will control runoff from 29,720 acres (33 percent) of the watershed.

Public access areas, sanitary facilities, and minimum recreation facilities will be provided at Structure No. 1. Use of the structure for incidental recreation will be kept in compliance with all applicable laws of the North Carolina Department of Human Resources, Division of Health Service.

A water intake for municipal and industrial water supply will also be constructed in conjunction with Structure No. 1.



SECTION OF A TYPICAL
MULTIPLE-PURPOSE STRUCTURE

Figure 2

Improvement

Multiple-purpose structure No. 4, to be located on South Country Line Creek, will have additional storage capacity for recreational use. Its compacted earthfill dam will be 59.0 feet high. A 4.5-foot x 4.5-foot concrete monolithic box emptying into an energy dissipator will pass through the dam, and the reinforced concrete riser will set the permanent pool at elevation 490.0 feet mean sea level. At this water level, the structure will have 1,280 acre-feet of sediment storage, and 12,620 acre-feet of recreational storage. The upstream face of this dam will also be riprapped to four feet above the permanent pool. The foundation under the principal spillway will be yielding.

A two-part emergency spillway system will be employed on this structure. The two spillways will be set at elevation 500.5 feet mean sea level and will be located in rock. These emergency spillways may also require some "dental grouting". The frequency of use of the spillway system will be less than one percent and the structure will have 7,800 acre-feet of floodwater storage. It will control runoff from 17,340 acres (19.2 percent) of the watershed.

In conjunction with structure No. 4, there will be a recreational development constructed (see recreational development map). This development will include such facilities as parking spaces, picnic tables, grills, boat ramps and docks, rest rooms, camp sites, access roads, etc. Table 2B shows the number of each type of facility planned. Structure No. 4 is expected to have an annual visitation of 104,200, with a maximum design capacity of 1,625 persons. (See PROJECT BENEFITS for a explanation of these computations.)

The public recreational lake will have a surface area of 640 acres at elevation 490.0 feet mean sea level. Land rights will be acquired in fee simple for the dam, spillway, recreation area, and reservoir area up to a line representing the elevation of the permanent pool, plus 100 feet horizontally. The land required amounts to 908 acres for the reservoir area, dam and spillway, and 770 acres for the facilities area. Flowage easements on 40 acres in the upper parts of the arms of the reservoir will also be required. Approximately one mile of Secondary Road 1736 will be abandoned and replaced by 1.4 miles of new road to be located below the dam.

The water supply for the public recreational development will come from drilled wells and be piped to all use areas. Package sewage treatment plants with tertiary treatment will be installed at four different locations. One plant will provide treatment for Areas 1 and 2 and one plant each for Areas 4, 5, and 6. (See recreational development map.) The plant will be constructed to meet requirements of sanitation laws of the State of North Carolina.

An electric system will be installed which will furnish power to all public buildings. Outlets for campers will be provided in Area 6 (see recreational development map).

Area 1 (see recreational development map) is a group camping area. Facilities will consist of sanitary facilities, parking areas, picnic tables, water fountains, grills, waste receptacles, boat dock and ramp, and pads for tenting or similar type camping.

Area 2 (see recreational development map) is an overlook and picnic area. Facilities planned are: parking area, sanitary facilities, tables, grills, a rustic picnic shelter, waste receptacles, and water fountains.

Area 3 (see recreational development map) is an overlook area only. Facilities are limited to a parking area and trees will be removed so that there is a clear view of the lake.

Area 4 (see recreational development map) will be a multiple-use-development. It will consist of a three-mile riding trail, boat dock and ramp, parking area, tables, grills, rustic picnic shelters, water fountains, and sanitary facilities.

Area 5 (see recreational development map) is for picnicking. Facilities will consist of a rustic picnic shelter, tables, water fountains, grills, waste receptacles, boat dock and ramp, parking area, and sanitary facilities.

Area 6 (see recreational development map) is planned as a trailer-type camping area. Facilities will consist of camp sites, a bath house, tables, grills, water fountains, waste receptacles, a boat dock and ramp, a parking area, and sanitary facilities. A sewage dump station will be included as a part of the bath house installation.

All imposed embankment areas, spillways, borrow areas, and other areas disturbed during construction will be vegetated as construction progresses. Debris basins, diversions, and similar measures will also be used, as needed, to prevent sediment damage during construction. Construction will also be contracted and let seasonally so as to minimize erosion and sediment.

EXPLANATION OF INSTALLATION COSTS

Land Treatment

The estimated total cost of the land treatment program is \$852,300. Of this amount \$129,000 will be provided under authority of Public Law 566 and \$723,300 will come from other sources.

Conservation land treatment on open land is estimated to cost \$666,200. The Soil Conservation Service will contribute \$72,300 of this amount under Public Law 566, consisting of \$12,500 for cost sharing on critical area planting (grasses and legumes) and \$59,800 for technical assistance. Other sources will contribute the remaining \$593,900. This amount includes

Costs

\$4,200 to be contributed by individual landowners for critical area planting (grasses and legumes). A major source of other funds will be the going soil and water conservation program, where costs for land treatment measures are shared with landowners to various degrees under the Rural Environmental Conservation Program.

The estimated cost of land treatment for the forestlands of the watershed is \$186,100. Of this amount, \$56,700 are P.L. 566 funds and \$129,400 are to be provided by other sources. The P.L. 566 funds provide \$53,000 for technical assistance and \$3,700 for cost sharing of tree planting on critically eroding areas.

One of the other sources of funds will be the North Carolina Division of Forest Resources which will provide \$7,800 in accelerated technical assistance, capital outlay of \$33,000 under the going Cooperative Forest Fire Control Program, and additional services valued at \$3,000 under the going Cooperative Forest Management Program. Deducting the North Carolina Division of Forest Resources' contribution from total other funds leaves \$85,600 which is to be provided by individual landowners and operators with sharing assistance available under the Rural Environmental Conservation Program.

Structural Measures

The installation cost (including project administration) of the two multiple-purpose structures is summarized in Table 1. Total installation cost of both structures and recreational facilities is estimated to be \$5,010,450, of which \$2,579,810 is P.L. 566 cost and \$2,430,640 is from other funds. Additional detail is found in Table 2 where costs are shown from individual measures.

Construction cost of each measure is the estimated contract cost and includes all materials, equipment, and labor involved. Unit costs were calculated from current prices for doing similar work in North Carolina and applied to detailed estimates of quantities for each measure. A 15 percent contingency is added to cover unforeseen items during construction. For this project, P.L. 566 will pay 100 percent of construction cost allocated to flood prevention and 50 percent of the construction cost allocated to public recreation. Construction cost allocated to municipal and industrial water supply is not eligible for P.L. 566 assistance. Total construction cost is estimated to be \$3,295,000, of which \$1,667,900 is from P.L. 566 funds and \$1,627,100 is from other funds.

Engineering services include geological investigations, surveys, and design of the works of improvement. Public Law 566 funds will provide all engineering services associated with flood prevention, all engineering services associated with public recreation in structure No. 4 and

50 percent of engineering services associated with public recreational facilities. There will be no contribution of P.L. 566 funds to engineering services allocated to water supply. It is anticipated that an A&E contract will be used to provide engineering services for structure No. 1. and recreational facilities associated with structure No. 4. Total engineering services costs are estimated to be \$239,800, of which P.L. 566 funds will provide an estimated \$147,500 and \$92,300 are to be provided from other funds.

Project administration costs include cost of construction inspection, administrative costs, relocation assistance-advisory services, and the cost of administration of contracts. Total project administration costs are estimated to be \$453,000, of which \$409,500 is from P.L. 566 funds and \$43,500 from other funds. Included in the contribution by other funds is \$30,000 for construction inspection.

Land rights cost for structure No. 1 amounts to \$297,750, and will be paid for entirely by the sponsoring local organization. Included in this cost are \$261,000 for fee simple purchase of 870 acres of land (dam and spillway, structure area, and five-acre public access area), \$21,750 for flowage easements on 145 acres, and \$15,000 for modification of Secondary Road 1122.

The total land rights cost for structure No. 4 is \$611,400. An amount of \$503,400 is included in this for the fee simple purchase of 1,678 acres of land (dam, spillway, reservoir area, recreation facilities area) and Public Law 566 will pay 50 percent of this amount while the sponsors will pay the other half. Also included is \$6,000 for flowage easements which will be paid for entirely by the sponsoring local organization. The purchase of several houses and other buildings at an estimated value of \$52,000 is a third component of land rights cost and will also be cost shared at the rate of 50 percent by P.L. 566 funds. Modification of Secondary Road 1736 is the final component of the land rights cost. This modification, to be shared at 50 percent by P.L. 566 funds, is projected to cost \$50,000.

Relocation costs are for securing decent, safe, and sanitary housing for persons displaced by the project and for replacement costs of farms. A total of nine relocations of families and six displacements of farms will be involved with installation of the proposed structures. It is estimated that these displacements will cost \$113,500.

The Alternative Justifiable Expenditure Method was used for both multiple-purpose structures. The cost of land required for the permanent pool of structure No. 1, plus a 100-foot strip around the pool was allocated to municipal and industrial water supply. The remaining land rights cost was considered a joint cost. All land rights cost for structure No. 4 was considered a specific cost to recreation, except for 40 acres of flowage easements (\$6,000) in the upper end of the reservoir.

Costs

For structure No. 1, 58.4 percent of the joint costs were allocated to municipal and industrial water and 41.6 percent to flood prevention. The estimated installation cost (exclusive of project administration) of the structure is \$1,702,750, of which \$1,055,970 was allocated to municipal and industrial water supply. Of the total allocated cost, P. L. 566 will provide \$582,200 and other funds \$1,120,550, including specific costs of \$6,000 for a water release gate.

In structure No. 4, 74.0 percent of the joint costs of the structure itself were allocated to recreation and 26.0 percent to flood prevention. The estimated installation cost (exclusive of project administration) of this structure is \$1,419,400, of which \$1,129,740 is recreation cost and \$289,660 is flood prevention cost. Of the total cost (exclusive of project administration) P. L. 566 will provide \$874,800 and other funds will provide \$544,640.

All cost for the recreational area was considered recreation cost. The installation cost (exclusive of project administration) for recreation facilities area is estimated to be \$1,435,300, of which P. L. 566 will provide \$713,310 and other funds \$721,990.

Schedule of Obligations

Expected expenditures in accordance with planned schedule of operations are as follows:

<u>Land Treatment</u>		
<u>Year</u>	<u>P. L. 566 Funds</u>	<u>Other Funds</u>
First	\$ 20,970	\$110,660
Second	\$ 23,620	\$127,375
Third	\$ 23,620	\$135,980
Fourth	\$ 23,620	\$119,345
Fifth	\$ 20,970	\$119,345
Sixth	<u>\$ 16,200</u>	<u>\$110,595</u>
Total	\$129,000	\$723,300
<u>Structural Measures</u>		
First	\$ 118,700	\$ 346,300
Second	\$ 639,500	\$ 815,750
Third	\$ 276,450	\$ 169,200
Fourth	\$ 997,510	\$ 610,240
Fifth	\$ 520,275	\$ 493,775
Sixth	<u>\$ 27,375</u>	<u>\$ 875</u>
Total	\$2,579,810	\$2,436,140

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion, and Sediment

Structural measures in combination with the land treatment measures will reduce flooding and flood damages on 1,920 acres of flood plain land downstream from the two structures. Flood protection will be sufficient to reduce 70 percent of all the average annual floodwater damages. Reduction of damages will range from about 90 percent in Reaches 1 and 2, to about 60 in Reach 4 (see project map). Areas to be protected from flooding with the project from various size storms are: one-year frequency -- 613 acres; two-year frequency -- 458 acres; 10-year frequency -- 345 acres; 100-year frequency -- 307 acres. The average annual acres flooded will be reduced from 3,182 acres to 1,534 acres (52 percent).

Land treatment measures will have beneficial effects on 10,640 acres of crop and pasture land and 4,255 acres of forestland. Sheet erosion in the watershed will be reduced about 151,400 tons (65 percent) after land treatment measures are installed. Critical area erosion will be reduced by 1,740 tons (84 percent) annually. Considering the watershed as a whole, a total annual erosion from all sources will be reduced by 154,100 tons (68 percent).

As erosion rates are reduced, related sediment damage will also be reduced. Reduction in sediment delivery will result in a 31 percent reduction of damages from infertile deposition. The combined effect of the land treatment and structures will effect a decrease in sediment delivered from the watershed outlet to the Dan River of 56,385 tons annually (394 milligrams per liter) and a reduction of 11,275 tons of sediment delivered to Kerr Lake annually.

Since sediment has been shown to be one of the greatest avenues of loss of farm chemicals (fertilizers, pesticides, etc.) reductions in erosion and sediment delivery will improve the water quality of watershed streams. Researchers, such as Smith (24) and Taylor (25) have shown that phosphorous, nitrogen, potassium, etc., move into watercourses attached to sediment particles. These are the plant nutrients that cause eutrophication problems in lakes and other water bodies. Although figures are not available which show the amounts of sediment-derived plant nutrients and other chemicals in Country Line Creek and Dan River, it is a fact that the 68 percent reduction in total erosion from the watershed and the 56,385 tons reduction in sediment delivered into Dan River will cause some decrease in such chemicals in these two waterways.

The land treatment will tend to decrease the rate of runoff from treated areas under certain conditions. This helps, to a limited extent, in reducing flooding, but flood runoff cannot be completely eliminated by land treatment, however. Land treatment measures which result in deep

Effects

fertile topsoil, a high level of organic matter, good tilth and vegetative cover, increase the infiltration rate and moisture holding capacity of the soil. In addition to reducing runoff, this also makes more water available for crop production and ground water recharge. The effects of land treatment in reducing flooding are most noticable on the small, short duration rainfalls. During major floods, however, the soil is usually saturated and treatment measures have little effect in reducing peak rates of runoff.

As a result of the conservation land treatment program and the proposed structures, the following changes are expected in land uses in the watershed.

Losses Gains	Cropland	Hay and Pasture	Forestland	Idle	Miscell aneous (roads, home sites, etc)	Total Losses
Present Use	16,287	7,659	60,072	1,738	3,017	
Cropland		349	743	7	1,018	2,117
Hay & Pasture						
Pasture-land	107	-	603	-	296	1,006
Forest-land		38		-	1,497	1,535
Miscell-aneous	-	-	-	-	-	-
Idle	263	550	534	-	67	1,414
Total						
Gain	370	937	1,880	7	2,878 ^{1/}	6,072
Net Change	(1,747)	(69)	345	(1,407)	2,878	
Future Use	14,540	7,590	60,417	331	5,895	

^{1/} Includes land for structures, permanent pools, recreational development area and wildlife habitat.

The tree plantings as part of the forestry phase of the land treatment will contribute to an increase in the economy of the watershed through the sale of various forestry products.

Through continued efforts of protection and management the forest resource hydrologic condition will improve resulting in a decrease in the amount of runoff.

Included in the land use changes cited above are some conversions expected within the flood plain below the proposed structures. These estimated changes are as follows:

<u>Land Use</u>	<u>Present (acres)</u>	<u>Future Without Project (acres)</u>	<u>Future With Project (acres)</u>
Corn	131	96	369
Pasture	242	162	193
Tobacco	8	-	8
Idle	29	60	-
Woods	1,418	1,510	1,258
Miscell-aneous	92	92	92
Total	1,920	1,920	1,920

Water Supply

The construction of structure No. 1 will supply the badly needed municipal and industrial water supply. At normal level the structure will contain 3,000 acre-feet (one billion gallons) of storage for this purpose. This should supply the area's needs until at least the year 2000. This water supply should provide an excellent incentive for the development of industry around Yanceyville and Caswell County. According to the sponsors, the lack of a sufficient water supply has been a limiting factor in attracting industry.

Some increased ground water recharge can be expected as a result of the impoundments and their sustained release flows. Both sites will have a permanent pool (standing water) at all times. Based on field investigations, no excessive seepage losses are expected from any site, and therefore, no large volumes of ground water recharge will occur from the structures. Minor amounts of natural seepage (incidental recharge) will occur throughout the pool areas where exposed rock contains fractures and joints. No practical estimate of this increase in recharge around the impounded areas was made. The quality of water which will infiltrate the soils and rocks beneath the pools will not adversely affect the quality of the existing ground water resource within the watershed. Water that will be coming into structure No. 1 is presently class "A-II" and water that will be coming into structure No. 4 is class "B." Both classifications indicate high quality water.

Fish and Wildlife and Recreation

The two impoundments will convert approximately eight miles of streams to 1,030 acres of permanent reservoir water. However, only one segment of these streams is listed in A Catalog of Inland Fishing Waters in North Carolina as having significant fishery. This is the segment of Country Line Creek to be inundated by structure No. 1. The segment is listed with an ecological classification of dace-trickle. The average weight per surface-acre of streams of this type in the Roanoke River Basin has been computed at 13.8 pounds (20). On the other hand, the productivity of the impounded structures should be considerably higher. The estimated maximum potential sustained annual harvest would be 100 pounds per surface-acre (33). The fish species in the eight miles of stream will be changed from stream types to reservoir types (bluegill, bass, etc.).

The effects of the structures on the water temperatures and dissolved oxygen levels of the streams on which they are to be located, were analyzed after a review of the literature. Considerable information is in the literature on water temperatures, stratification, dissolved oxygen, etc., in large reservoirs, such as Fontana Lake. However,

Effects

temperature and oxygen regimes in smaller reservoirs like those planned in Country Line Creek would not compare with those in larger reservoirs. Excerpts from some of the literature references are summarized in the following paragraphs.

Impounded water warms up more than that in the stream due to the increased surface area exposed to thermal effects of the sun. Circulation of water in ponds is such that limited stratification of temperature or oxygen occurs. During the summer, top waters become warmer than bottom waters; as a result, only the warm top layer (called the epilimnion) circulates and it does not mix with the colder bottom layer (called the hypolimnion). This creates a zone with a steep temperature gradient in between (called the thermocline). If the thermocline is deeper than effective sunlight penetration, the oxygen supply in the hypolimnion is rapidly depleted. If stratified waters are transparent enough to permit growth of phytoplankton below the thermocline, oxygen will be present. (34).

Stratified lakes with top-water releases discharge the warmer surface waters and tend to trap nutrients from upstream. A bottom-water release from such lakes would retain the warmer waters and release the colder, nutrient-rich, bottom waters (35). Such releases from an oxygen-poor hypolimnion would be low in oxygen; however, the water is quickly re-aerated by stream turbulence. Dillon (36) states that water from the bottom of a floodwater retarding structure picks up oxygen as it goes through the primary outlet and is normally saturated when it comes out below the structure.

Schumacher (37) found that water drawn 10 feet below the surface of a relatively small reservoir (4.3 surface-acres) was discharged an average three degrees Fahrenheit warmer than the stream inflow during the summer months. This study was made in the mountains of Georgia where average air and stream temperatures were cooler than would be expected in the piedmont area.

Both of the planned Country Line Creek reservoirs will have more surface area exposed to the sun than in the Georgia study, thereby tending to heat the water more. However, both the reservoirs are to be at least 40 feet deep. They should stratify in the summer, causing water being drawn from near the bottom to be as cold or colder than that of the incoming stream. The principal spillway system of the structures will be constructed so that the water will have the necessary turbulence to pick up oxygen as it is discharged from the structures. Any adverse effects to the fishery resources in the reaches downstream from the structures as a result of increased water temperatures or lower dissolved oxygen levels should be avoided.

The project, when installed, will actually enhance the fishery resources in the lower reaches of Country Line Creek and in the Dan River from a standpoint of a reduction in sediment and associated pollutants being delivered to these downstream areas. Fish food organism production and spawning success should improve as a result of sediment reduction. The structures will block access to the upper reaches of Country Line and South Country Line Creeks, if any fish in the lower reaches actually migrate this far upstream to spawn.

No adverse effects will result to the streams below structures from a low flow or base flow standpoint. During the periods of normal inflow to the structures, that outflow will approximately equal the inflow. This assures that the normal flow of the stream below the structure remains about the same as it would be with no structures. The low flow orifices on the planned structures will insure that a flow at least equal to the 10-year, seven-day low flow or .50csm will occur in the reaches below the structures at all times. This is equivalent to 1.50MGD for structure No. 1 and .875MGD for structure No. 4.

The cool water release orifice will be located at a depth great enough to insure outflow at temperatures at or below inflow temperature. If the hypolimnion exists at 15 ft below the permanent water surface and the cool water release orifice is located 25 ft below the surface, outflow cooler than inflow can be assured. For the extreme condition of inflow less than or equal to evaporation loss and a cool water release configuration as described above with an outflow of .5csm, analysis shows that Structure #1 and Structure #4 will provide 24 and 139 days respectively of cool water release before discharging water from the thermocline zone.

Approximately 1,100 acres of wildlife habitat will be eliminated in the dams, spillways, and permanent pool area of the two impoundments. Of this area to be lost to structures, 150 acres are in cropland or pastureland and the remaining 950 acres are in woodland. In addition, due to the recreational development and heavy human use at structure No. 4, wildlife habitat in and around the recreational facilities will be detrimentally affected. Also, there are approximately 655 acres of forestland, cropland, and pastureland in the flood pool area which will be periodically inundated. The duration of flooding on these lands will be of such a limited extent, however, that their value as wildlife habitat should not be significantly affected. The primary detrimental effect which might result would be to increase the hazard to reproduction of small game species, such as rabbit and quail.

The wildlife habitat development on private lands should improve populations of upland game within the watershed area. This development will provide increased food supply, better cover, etc. The 640 acres of habitat development planned for this watershed, when added to the 12,700 acres in the Caswell Wildlife Management Area, will represent a five percent increase in total managed wildlife area in the watershed. Waterfowl will probably use the two impoundments to a limited degree as resting areas, food supply, and nesting areas. However, the heavy recreation use around structure No. 4 will keep this use to a minimum there.

Effects

Multiple-purpose structure No. 4 will provide an estimated 104,200 visitor-days of recreation annually to the watershed and nearby residents. A visitor-day is defined as one individual going to the structure on one day. Daily capacities for each type activity provided are as follows: camping - 480, boating - 272, fishing - 150 and picnicking - 725. The construction of structure No. 1 will produce incidental recreation estimated at 30,800 visitor-days annually.

(See PROJECT BENEFITS for calculation of annual visitor-days of recreation.) Development of these two reservoirs will provide high quality, publicly accessible water-based recreational opportunities for watershed residents, a situation which does not presently exist.

Archaeological, Historic, and Scientific

An archaeological survey made through a contract with the North Carolina Department of Cultural Resources, Division of Archives and History investigated the areas to be disturbed by the proposed project for sites of archaeological significance. The survey report recommended extensive tests be made at one site (Cs12) with intensive investigation in the area of greatest artifactual concentration in order to determine the advisability of full-scale archaeological research. This site is located in a field of SR 1750 just east of the confluence of Pension and Burkes Creeks and is in the proposed recreational development area of structure No. 4.

The Division of Archives and History also made a comprehensive architectural inventory of historic sites in Caswell County. They suggested that Womack's Mill, a large frame grist mill located in the permanent pool of structure No. 1 would possibly be eligible for inclusion in the National Register. The Department of the Interior determined that both Cs12 and Womack's Mill would be eligible.

The archaeological site will be located on design plans, protected during construction, and seeded to blend in with the remaining areas in the development. Meetings with the State Historic Preservation officer and representatives of the Advisory Council on Historic Preservation Officer and representatives of the Advisory Council on Historic Preservation are being held to insure compliance with PL 93-291 and Executive Order 11593 concerning Womack's Mill.

The National Park Service will be notified if any previously unidentified evidence of cultural values are discovered during detailed investigations or construction and procedures in PL 93-291 will be followed.

General

It has been estimated that the project will generate 80 man-years of employment during the installed period. Expenditures of funds during the project installation will pay \$650,000 into the localeconomy as wages. Three jobs will be created, either directly or indirectly, for local labor to operate and maintain the structural works of improvement and the recreational facilities. It is estimated that the increase in agricultural production will create six jobs.

Approximately 123 farms will be benefited by the project. More efficient use of land, labor, and capital resources will permit improvement in the economic condition of farm families. Reduction of flooding will result in increased production from flood plain soils.

Installation of the project will result in increased noise, litter, dust, etc., around the area of work during construction. Observation of the project map, however, shows that neither of the proposed structures are located within or nearby towns. Therefore, any inconvenience as a result of the construction will be limited to those persons living in rural areas around the construction. There is expected to be no major disruptions of rural community life as a result of the project. Vector controls, in compliance with North Carolina state law, will be enforced around the construction areas.

Local business will be stimulated by providing goods and services to the recreational site visitors. Examples would include increased business to service station owners, bait and tackle dealers, sporting goods dealers, etc. Secondary benefits are also derived from the storage of a municipal and industrial water supply and from increased cost of farm production associated with increased farm output.

Redevelopment benefits will result from the income provided to unemployed and underemployed labor during the construction phase of the project and for operation and maintenance of the project. Living conditions for the unemployed and underemployment should improve as job opportunities are provided them.

It is estimated that securing land rights for the structures will cause nine displacements from dwellings and six displacements from farms, as defined by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

Structure No. 4 will account for all nine of the dwelling displacements and five of the farm displacements and structure No. 1 will account for one farm displacement.

The quality of living for the nine families displaced will probably be improved after the project installation. The law requires that replacement housing be safe, sanitary, and decent, regardless of the condition of the present dwelling. The law also requires that a relocation assistance advisory service be provided to the displaced persons. It is the general intent of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, that no displaced person, business, or farm operation shall suffer an economic loss as a result of project measures.

One road (Secondary Road 1736) will have to be rerouted in conjunction with the construction of structure No. 4. About one mile of the present road will be replaced by construction of 1.4 miles of new road below the dam. Secondary Road 1122 will be raised in connection with structure No. 1. Modification of this road will cause some temporary inconvenience to watershed residents.

Four packaged treatment plants will provide tertiary treatment of the sewage at the recreational development area. The effluent discharge will be in compliance with all North Carolina public health laws and should not present any serious water quality problems.

Approximately 1,100 acres of forestland, cropland, and pastureland will be permanently converted to water, spillways, and dams as a result of the project. In addition, a recreational development will permanently occupy 771 acres around structure No. 4. A capital expenditure of \$5,495,340 will also be permanently committed with installation of the project. These will be the only irreversible commitments of a resource involved, except for the labor and energy required.

PROJECT BENEFITS

The proposed project will provide total flood damage reduction benefits estimated at \$43,110 annually. This amount includes an \$8,870 reduction in damages to crops and pasture, a \$2,870 reduction in damages to other agricultural property, and an \$800 decrease in road and bridge damage.

The planned land treatment measures will bring about benefits to cropland through erosion reduction. The monetary value of these benefits has been estimated at \$850 annually. In conjunction with reduced erosion, sediment damages will also be decreased. Damages resulting from overbank deposition will be reduced by \$4,925 and sediment damages occurring to Kerr Lake (loss of capacity) will be decreased by \$15,900. Of the total sediment damage reduction benefit, \$6,000 will result from the land treatment and \$19,140 will stem from the "trap" effect of the structures.

Benefits derived from the storage of the municipal and industrial water supply are estimated to be \$0.10 per 1,000 gallons of water stored. Applying this figure to the one billion gallons of water stored for this purpose, would give annual benefits of \$100,000.00. The value of \$0.10 per 1,000 gallons of municipal and industrial water stored was estimated by a firm of consulting engineers retained by the sponsors. Their estimate was also concurred in by the Soil Conservation Service.

More intensive land use benefits will amount to \$7,800 annually. These benefits stem from using land at a higher level of productivity than would be possible if it were not protected as it will be by the project.

The provision of a publicly accessible water-based recreation facility at structure No. 4 will result in annual benefits estimated at \$156,300. Incidental recreation benefits at structure No. 1 will have a value of \$30,000. In arriving at this estimate for structure No. 1 the cost for providing the public access facilities plus the annual operation and maintenance cost (including repair and replacement of facilities) has been deducted.

In arriving at the estimated annual visitor-days of recreation at structure No. 4 the following calculations and projections were made.

- (1) Summer use camping was calculated by projecting occupancy of one-third capacity over a 13 week period. (13 weeks x 7 days/week x 480 campers day x $\frac{1}{3}$ = 14,414 summer activity occasions for camping.) In addition it was projected that there would be one other camping activity occasion during the remainder of the year for each summer visit, giving a total of 28,828 annual activity occasions for camping.

Benefits

- (2) Boating use (other than fishing) was calculated by projecting that the lake has a daily capacity of 68 boats with four persons per boat and that this daily capacity represents 47 percent of the weekly use. This weekly use rate is projected to occur over a 13-week summer period. In addition it is projected that there will be one other annual visit for each summer visit. (68 boats/day x 4 persons per boat x 13 weeks x 100/47 = 7,523 activity occasions per summer.) (7,523 summer activity occasions x 2 = 15,046 activity occasions per year.
- (3) Annual fishing use calculated by projecting that each acre would provide 85 visitor occasions for fishing each year. (640 acres x 85 visitor occasions/year = 54,400 visitor occasions for fishing.
- (4) It was projected that each picnic table would provide 200 activity occasions per table during the 13-week summer use period plus one other annual activity occasion for each summer visit. (145 tables x 200 activity occasions per table x 2 = 58,000 annual activity occasions for picnicking.
- (5) To arrive at the annual visitor-days of recreation, annual activity occasions for each activity were summed and divided by 1.5 to allow for participation in more than one activity by a single individual. (28,828 + 15,046 + 54,400 + 58,000 = 156,274 activity occasions ÷ 1.5 = 104,183 visitor-days -- rounded to 104,200 for use in work plan).

Annual visitor-days of fishing at structure No. 1 were calculated by assuming that each surface-acre would supply 80 visitor-days per acre per year.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the two structures, including operation and maintenance, will be \$335,000 (using 5-5/8 percent interest rate). Average annual benefits from the structures, including secondary benefits, total \$414,660, giving a benefit cost ratio of 1.2 to 1.0 (see Table 6). Excluding the secondary benefits (\$37,000) would result in a benefit cost ratio of 1.1 to 1.0.

PROJECT INSTALLATION

It is estimated that the installation period of this project will be approximately six years. This period is estimated from the time that funds are appropriated by Congress for the project and includes the land treatment program as well as the structural measures.

Land treatment measures will be applied by the landowners and operators at their expense in co-operation with their respective soil and water conservation districts. The districts will make available technical assistance for the planning and application of these measures. Public Law 566 funds will be used to accelerate the assistance available from the soil and water conservation district program. This extra technical assistance will increase the rate of planning and application, including necessary soil surveys.

Critical area stabilization measures will be installed on a division of work arrangement between the sponsoring local organization (Caswell County Board of Commissioners) and the Soil Conservation Service. The sponsors will provide for the labor and equipment necessary for installation such as seed-bed preparation and planting. The service will provide the necessary materials such as seed, fertilizer, and trees.

Forest landowners will be encouraged to apply and maintain the forestry measures on their land. The United States Forest Service will co-operate with the North Carolina Division of Forest Resources to provide technical assistance in the planning and application of forestry land treatment measures on the watershed. A forester trained in watershed management will be assigned to the project to assist landowners in the installation of the planned measures. One of the first objectives of the watershed forester will be the preparation of watershed management plans for the forested lands as part of the conservation farm plans.

The soil and water conservation districts concerned will obtain agreements to carry out recommended soil conservation measures and farm plans from owners of not less than 50 percent of the lands situated in the drainage area above each retention reservoir to be installed with federal assistance.

Prior to providing financial assistance for the construction of any planned structural measures, at least 75 percent of the effective land treatment measures must be installed; or their installation commenced on those sediment source areas which, if uncontrolled, would require material increase in the cost of construction, operation and maintenance of structural works of improvement.

Multiple-purpose structure No. 1 will be constructed the second project year. Land rights for multiple-purpose structure No. 4 will be secured during the third year and construction will be completed during the fourth year. Recreation facilities associated with structure No. 4 will be installed during the fifth year.

The Yanceyville Sanitary District and Caswell County Board of Commissioners will be responsible for the following in multiple-purpose structure No. 1:

1. All cost in acquiring land rights necessary for the reservoir, dam, and emergency spillway.
2. All costs of legal fees and administrative costs.
3. All construction and engineering costs allocated to storage of municipal and industrial water.
4. All costs associated with the water release gate.
5. Modifications of Secondary Road 1122.
6. An A&E contract for investigations, surveys, and design of the multiple-purpose structure.
7. Modifications of Secondary Road 1121.
8. Project administration costs which it incurs (including construction inspection).

The Soil Conservation Service will provide construction inspection and other costs and all of the cost of construction allocated to flood prevention from P. L. 566 funds.

The Caswell County Board of Commissioners will be responsible for the following in multiple-purpose structure No. 4:

1. Acquire all land rights needed for the multiple-purpose structure and recreational facilities adjacent to the recreation pool, 50 percent of the purchase cost of land purchased in fee simple, and 100 percent of the cost of flowage easements.
2. Rerouting of approximately one mile of Secondary Road 1736 in the vicinity of the dam site and 50 percent of cost incurred.

Installation

3. An A&E contract for the recreational facilities in the area adjacent to the recreation pool.
4. Non-federal costs of construction and engineering services for the recreational development.
5. Legal fees associated with the purchase of land.
6. Project administration costs which it incurs (including construction inspection).

The Soil Conservation Service will provide the following from P. L. 566 funds:

1. One-half the cost of land required to be purchased in fee simple for the multiple-purpose structure and associated recreational development.
2. One-half the cost of recreational facilities.
3. One-half the cost of A&E contract for recreational facilities.
4. All construction costs of the structure allocated to flood prevention.
5. One-half the construction cost of the structure allocated to storage of water for recreation.
6. Construction inspection and other project administration costs incurred by the Soil Conservation Service.

Relocation advisory assistance will be provided to the displaced farm operation involved with structure No. 1 by the Yanceyville Sanitary District and Caswell County Board of Commissioners. The Caswell County Board of Commissioners will provide service to displaced persons and farms around structure No. 4. The Soil Conservation Service will assist the sponsors in carrying out these responsibilities. The sponsors will assure that decent, safe, and sanitary housing will be provided to displaced persons and that all displaced persons will receive at least 90 days' notice before they have to move.

The Caswell County Board of Commissioners and the Yanceyville Sanitary District have sufficient legal authority, including raising funds by levy and the power of eminent domain, to acquire land rights needed for the project. This authority will be used as needed.

Installation

Structural works of improvement will be installed by the Caswell County Board of Commissioners. All items of constructions except public roads will be performed under contracts let, administered, and financed by the Caswell County Board of Commissioners. Public road modifications will be made by the North Carolina Department of Transportation and Highway Safety.

The Caswell County Board of Commissioners will develop and maintain a financial management system that will provide for disclosure of the financial results of each Public Law 566 undertaking in which the Soil Conservation Service has a financial interest in accordance with Soil Conservation Service reporting requirements.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement described in this work plan will be provided under authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended. This assistance is contingent upon the appropriation of funds for this purpose.

The following conditions must be met prior to the Service providing financial assistance for the construction of any planned structural measures: (1) the sponsoring local organization will obtain agreement with landowners to carry out soil and water conservation plans on at least 50 percent of the area above each multiple-purpose structure; (2) provide for adequate treatment of not less than 75 percent of the critical areas above each structural measure; (3) obtain land rights for structural measures prior to signing project agreement; and (4) specific operation and maintenance agreements must be executed.

Installation cost of land treatment measures will be provided by individual landowners concerned, P. L. 566 funds, and funds available through the soil and water conservation district programs and other going programs. A considerable part of the landowners' costs will be furnished in the form of labor and use of farm equipment. It is expected that farmers will utilize available cost sharing and other assistance from the Rural Environmental Conservation Program. The present rate of technical assistance and cost sharing for critical area planting will be provided from P. L. 566 by the Soil Conservation Service and the United States Forest Service.

The federal share of the installation cost of structural measures, including recreational facilities, will be paid from P. L. 566 funds through the Soil Conservation Service. Non-federal costs of multiple-purpose structure No. 1

Financing

consisting of construction, engineering, land rights, and contract administration will be provided by the Yanceyville Sanitary District and Caswell County Board of Commissioners. The Caswell County Board of Commissioners will pay the non-federal cost of multiple-purpose structure No. 4 and associated recreational development, consisting of construction, land rights, legal fees, flowage easements, recreational facilities cost, A&E contract cost of engineering services, and administration of contracts.

Several sources of funds will be available for financing the local share of cost. This would amount to a combined tax fund of \$559,000 (including interest) by 1978. The Yanceyville Sanitary District has pledged \$50,000 for the project. Another \$200,000 is expected from the county's share of North Carolina Clean Water Bonds.

Another source of funds is expected when loans and grants become available under the Public Works and Economic Development Act of 1965 (PL-89-136). Any remaining local share of costs can be paid by bonds sold to Farmers Home Administration. The Farmers Home Administration has been contacted by the sponsors in regard to loans for this purpose. The sponsors feel that by the time structure No. 4 is completed, the county will be collecting at least \$50,000 per year from the watershed tax, which could be used to repay any Farmers Home Administration bonds. The sponsors feel that at no time will the watershed tax rate be more than \$0.07 per \$100 valuation.

Recreation user fees will be to pay operation and maintenance cost of structure No. 4 and the recreational facilities.

The sponsors have thoroughly analyzed their financial capability in regard to the obligations they would incur if the project is installed. They definitely believe they can finance their share of the project cost.

Prior to entering into agreements that obligate funds of the Service the Caswell County Commissioners will have a financial management system for control, accountability, and disclosure of PL 566 funds received and for control and accountability for property and other assets purchased with PL 566 funds.

Program income earned during the grant period will be reported on the sponsor's request for advance or reimbursement from the Service.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment

Land treatment measures for open land will be maintained by the landowners or operators of the land on which these measures are installed. This work will be encouraged through the soil and water conservation districts with technical assistance furnished by the Soil Conservation Service.

Landowners and operators will maintain the forestry land treatment measures under agreement with the Caswell County and Rockingham County Soil and Water Conservation District. The North Carolina Division of Forest Resources, in co-operation with the United States Forest Service, will provide technical assistance necessary under the going Cooperative Forest Management Program. They will continue to furnish fire protection under the going Cooperative Forest Fire Control Program.

The district supervisors or their representatives will make a periodic review of the land treatment measures installed to see that they are adequately maintained. Critical sediment source areas treated under the project will be included in this inspection.

Structural Measures

The Yanceyville Sanitary District and Caswell County Board of Commissioners will operate and maintain multiple-purpose structure No. 1, including the water intake system and the public access facilities. Multiple-purpose structure No. 4, including the recreational development, will be operated and maintained by the Caswell County Board of Commissioners.

Structural works of improvement will be operated in such a manner that they will serve the purpose, both as to function and time, for which they were installed. The maintenance of both structures will consist of, but not limited to, the following:

1. Removal and disposal of debris from principal and emergency spillways.
2. Refilling, smoothing, and vegetating rills on embankments, spillways, and drainageways.
3. Maintenance of good vegetative cover.
4. Replacement of metal used in construction, as required, for proper structural function.

Services that will be specifically required to operate and maintain the recreational development are:

1. Superintendent.
2. Additional semi-skilled labor, such as carpenters, mechanics, etc.
3. Additional laborers for ground care, road repair, trash pickup, etc.
4. Additional compensation, medical, or other workers' benefits.

Operating supplies for the development will include:

1. Seed, fertilizer, paint, lumber, etc.
2. Repair parts for water systems, machinery, etc.

Operation and Maintenance

3. Utilities (telephone, electricity, etc.)
4. Sanitary supplies (soap, paper products, etc.).
5. Fuel, grease, etc., for motor equipment.

Equipment around the development which will require replacement includes:

1. Maintenance shop, office, and furnishings.
2. Tractor for mowing, seeding, etc.
3. Pickup or other truck for refuse collection and other use.
4. Boat and motor for rescue, enforcement, etc.
5. Playground or sports equipment.
6. Hand tools and minor equipment.

The replacement cost of these items has been included in the estimated annual operation and maintenance cost.

Specific operation and maintenance agreements will be executed between the Service and Sponsoring Local Organization (structure No. 1 - Yanceyville Sanitary District and Caswell County Board of Commissioners; structure No. 4 - Caswell County Board of Commissioners) prior to signing the project agreement. The North Carolina Watershed Operation and Maintenance Handbook will be used as a guide to prepare an operation and maintenance plan including fish and management on each structural measure.

Maintenance of structural measures will be force account or by contracts administered by the aforementioned county entity. Funds for maintenance will be raised by taxation or levy.

The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with PL 566 financial assistance.

The Soil Conservation Service and the sponsors will make a joint inspection annually, or after unusually severe storms, following installation of works of improvement.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COSTS

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

Installation Cost Item	Unit	Number	Estimated		Cost		Dollars			
			Non-Federal Land	PL-566	Non-Federal Land	Other	Non-Federal Land	Other		
									SCS	FS
LAND TREATMENT										
Land Areas 2/	Acres	2,599								
Cropland	to	2,163								
Grassland	be	4,225								
Forestland	Treated	628								
Other land										
Going Cooperative Forest Fire										
Control Program										
Critical Area Stabilization										
Tree Planting		30		3,700		3,700				
Grasses and legumes		37		12,500		12,500				
Technical Assistance				59,800		112,800				
TOTAL LAND TREATMENT				72,300		129,000				
STRUCTURAL MEASURES										
Construction	No.	2								
Multiple-Purpose Structures				1,184,650		1,184,650				
Recreational Facilities				483,250		483,250				
Water Intake										
Subtotal - Construction				1,667,900		1,667,900				
Engineering Services				147,500		147,500				
Relocation Payments				52,210		52,210				
Project Administration										
Construction Inspection				250,500		250,500				
Other				159,000		159,000				
Relocation Assistance Advisory Services										
Subtotal - Administration				409,500		409,500				
Other Costs										
Land Rights				302,700		302,700				
TOTAL STRUCTURAL MEASURES				2,579,810		2,579,810				
TOTAL PROJECT				2,652,110		2,708,810				

1/ Price base: 1973

2/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed and dollar amounts apply to total land areas.

3/ Includes \$3,000 from the going Cooperative Forest Management Program.

Date: December 1974

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

Measures	Unit	Applied to Date	Total Cost (Dollars) ^{1/}
<u>LAND TREATMENT</u>			
Conservation Cropping System	Acre	5,084	12,965
Crop Residue Management	Acre	2,619	8,900
Contour Farming	Acre	789	2,585
Field Border	Feet	66,506	33,250
Critical Area Planting	Acre	408	183,600
Grassed Waterway	Acre	578	13,000
Stripcropping	Acre	886	3,100
Minimum Tillage	Acre	585	1,265
Diversion	Feet	6,703	16,085
Land Smoothing	Acre	193	480
Terracing	Feet	620,000	1,953,000
Grasses & Legumes in Rotation	Acre	1,150	3,100
Cover & Green Manure	Acre	1,011	1,090
Pasture & Hay Management	Acre	463	27,780
Pasture & Hay Planting	Acre	4,033	604,950
Wildlife Habitat Management	Acre	667	33,350
Ponds	Acre	871	2,177,500
Tree Planting	Acre	1,035	150,075
Improvement Harvesting	Acre	990	1,960,200
Woodland Site Preparation	Acre	416	173,050
Recreation Area Improvement	Acre	154	7,700
TOTAL	xxxx	xxxxxxx	7,367,025

^{1/} Price base: 1973

Date: December 1974

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina
(Dollars)^{1/}

Item	Installation Cost		P. L. 566 Funds		Installation Cost		Other Funds		Total	
	:Construction	:Engineering	:Relocation	:Total	:Construction	:Engineering	:Relocation	:Total	:Construction	:Engineering
Multiple-Purpose Structure No. 1	542,050	37,850	2,300	582,200	760,950	53,150	2,700	297,750 ^{2/}	1,114,550	1,696,750
Water Intake				5,500		500			6,000	6,000
Multiple-Purpose Structure No. 4	642,600	71,000		874,800	377,400			167,200 ^{3/}	544,600	1,419,400
Recreation Facilities	483,250	38,650	49,910	713,310	483,250	38,650	58,590	141,500 ^{4/}	721,990	1,435,300
Subtotal	1,667,900	147,500	52,210	2,170,310	1,627,100	92,300	61,290	606,450	2,387,140	4,557,450
Project Administration	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	409,500	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	43,500	453,000
GRAND TOTAL	1,667,900	147,500	52,210	302,700	1,627,100	92,300	61,290	606,450	2,430,640	5,010,450

1/ Price base: 1973
2/ Includes \$15,000 for modification of a public road and \$1,500 for access facilities

3/ Includes \$50,000 for rerouting of Secondary Road 1736

4/ Includes \$52,000 for purchase of houses.

Date: December 1974

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

(Dollars) $\frac{1}{/}$

Item	COST			ALLOCATION			COST			SHARING		
	PURPOSE			P. L.			566			Other		
	Flood : Prevention:	M&I : Recreation:	Total : Water :	Flood : Prevention:	M&I : Recreation:	Total : Water :	Flood : Prevention:	M&I : Recreation:	Total : Water :	Flood : Prevention:	M&I : Recreation:	Total : Water :
Multiple-Purpose Structure No. 1	625,030	877,470	1,502,500	581,980	220 $\frac{2}{/}$	582,200	43,050	877,250	920,300			
Specific Costs:												
Water Intake		6,000	6,000					6,000	6,000			
Land Rights	21,750	172,500	194,250				21,750	172,500	194,250			
Multiple-Purpose Structure No. 4	283,660	807,340	1,091,000	283,660	429,940	713,600		377,400	377,400			
Specific Costs:												
Land Rights	6,000	322,400	328,400		161,200	161,200	6,000	161,200	167,200			
Basic Facilities		1,435,300	1,435,300		713,310	713,310		721,990	721,990			
GRAND TOTAL	936,440	2,565,040	4,557,450	865,640	1,304,450	2,170,310	70,800	1,260,590	2,387,140			

1/ Price base: 1973

2/ Relocation Cost

Date: December 1974

TABLE 2B - RECREATIONAL FACILITIES
ESTIMATED CONSTRUCTION COSTS

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

(Dollars) ^{1/}

Item	: Number	: Estimated Unit Cost	: Total Construction Cost
Parking Space	450	210	94,500
Picnic Table	145	170	24,650
Water Fountains	26	100	2,600
Grills	100	60	6,000
Waste Receptacle Holder	75	45	3,375
Boat Ramp and Dock	4	2,500	10,000
Rest Room	9	9,500	85,500
Camp Site	120	1,600	192,000
Picnic Shelter	4	8,500	34,000
Shower House	1	20,000	20,000
Sewage Disposal Plant	4	25,000	100,000
Water Supply & Distribution	1	30,000	30,000
Electric Distribution System	1	10,000	10,000
Horseback Trail - Mile	3.0	700	2,100
Improve Existing Roads - Mile	3.7	10,000	37,000
New Roads - Mile	4.3	37,000	159,100
Fencing - Mile	4.0	4,200	16,800
Miscellaneous (identification and directional signs, etc.)	---	-----	875
Landscaping	---	-----	12,000
Subtotal			840,500
Contingencies			126,000
Total Estimated Construction Cost			966,500

^{1/} Price base: 1973

Date: December 1974

TABLE 3 - STRUCTURAL DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

Item	Unit	Structure 1	Number 4	Total
Class of Structure		b	b	
Drainage Area	Sq. Mi.	46.5	27.1	73.6
Curve No. (1 day) (AMC II)		71	71	
Tc	Hrs.	8.0	4.0	
Elevation Top of Dam	Ft.	507.5	505.4	
Elevation Crest Emergency Spillway	Ft.	500.5	500.5	
Elevation Crest High Stage Inlet	Ft.	483.5	490.0	
Maximum Height of Dam	Ft.	70.5	59.0	
Volume of Fill	Cu. Yds	385,000	283,000	668,000
Total Capacity	Ac. Ft.	15,268	22,100	37,368
Sediment Submerged 100 years	Ac. Ft.	2,210	1,280	3,490
Sediment Aerated	Ac. Ft.	706	400	1,106
Beneficial Use	Ac. Ft.	3,190 (M)	12,620 (R)	15,810
Retarding	Ac. Ft.	9,162	7,800	16,962
Surface Area				
Sediment Pool	Acres	191	214	368
Beneficial Use Pool	Acres	390 (M)	640 (R)	1,030
Retarding Pool	Acres	830	855	1,685
Principal Spillway				
Rainfall Volume (areal) (1 day)	In.	7.20	7.30	
Rainfall Volume (areal) (10 day)	In.	12.66	12.75	
Runoff Volume (10 day)	In.	6.09	6.07	
Capacity of High Stage (Max.)	cfs	947	615	
Frequency Operation-Emer. Spillway	% chance	1	less than 1	
Size of Conduit	Ft.	5.5x5.5	4.5x4.5	
Emergency Spillway				
Rainfall Volume (ESH) (areal)	In.	7.85	7.77	
Runoff Volume (ESH)	In.	4.45	4.37	
Type		Rock	Rock	
Bottom Width	Ft.	300	300	
Velocity of Flow (V _e)	Ft/Sec	3.12	---	
Slope of Exit Channel	Ft/Ft	.0346	.04	
Maximum Water Surface Elevation	Ft.	501.2	499.5	
Freeboard				
Rainfall Volume (FH) (areal)	In.	14.03	13.80	
Runoff Volume (FH)	In.	10.09	9.88	
Maximum Water Surface Elevation	Ft.	507.5	505.4	
Capacity Equivalents				
Sediment Volume	In.	1.17	1.17	
Retarding Volume	In.	3.69	5.40	

(M) = Municipal & Industrial Water

(R) = Recreation

Date: December 1974

TABLE 4 - ANNUAL COST

Country Line Creek Watershed
Caswell and Rockingham Counties, North Carolina

(Dollars)^{1/}

Evaluation Unit	: Amortization of Installation Cost ^{2/}	: Operation and Maintenance Cost	:	Total
Multiple-Purpose Structure Nos. 1 and 4 with Recreation Development at Structure No. 4				
	257,400	52,000		309,400
<hr/>				
Project Administration	25,600	xxxxxxx		25,600
<hr/>				
GRAND TOTAL	283,000	52,000 ^{3/}		335,000

^{1/} Price base: 1973

^{2/} 100 years at 5-5/8 percent interest

^{3/} Includes \$50,000 for operation, maintenance, and replacement of equipment for recreational development.

Date: December 1974

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD
DAMAGE REDUCTION BENEFITS

County Line Creek Watershed
Caswell and Rockingham Counties, North Carolina
(Dollars)^{1/}

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasure	12,190	3,320	8,870
Other Agricultural	4,710	1,840	2,870
Non-Agricultural (Roads & Bridges)	1,000	200	800
Subtotal	17,900	5,360	12,540
Sediment			
Overbank Deposition	5,715	790	4,925
Swamping	4,620	305	4,315
Reservoirs	23,100	7,200	15,900
Subtotal	33,435	8,295	25,140
Erosion			
Flood Plain Scour	405	160	245
Streambank	270	125	145
Subtotal	675	285	390
Indirect	7,170	2,130	5,040
Total	59,180	16,070	43,110

^{1/} Price base: Adjusted Normalized and 1973

Date: December 1974

INVESTIGATIONS AND ANALYSES

Land Treatment

Present land use was determined from soil surveys, soil and water conservation district reports, and field studies. Estimates of future land use and treatment measures were made by the district conservationists on the basis of their knowledge of the land, people, and present trends in the watershed area. Needed land use adjustments based on land capabilities were considered in arriving at the land treatment measures planned for the watershed.

The importance of land treatment has been stressed at every meeting with the sponsoring local organizations. Every effort has been made to make them aware of the importance that land treatment measures will have in the project. The sponsoring local organizations anticipate that the acreage of surplus crops will not be increased as a result of the project.

Engineering

All vertical control for the structural measures is based on mean sea level datum as established by the United States Geological Survey bench marks in the area. Many temporary bench marks were established within the watershed by differential leveling.

A topographic map of the reservoir area of structure No. 1 was made using a plane table and telescopic alidade. This map was used to develop a stage-area and a stage-storage curve. A topographic map was made of the reservoir and adjacent area of structure No. 4 by means of U.S.G.S. topographic maps. This map was used to develop stage-area and stage-storage curves. It was also used to plan the recreational development.

Structures were flood-routed using methods outlined in Chapter 21, Section 4, National Engineering Handbook and the computer program at Fort Worth, Texas. Alternate principal spillway release rates and emergency sizes were flood-routed to determine the most economical structures. Release rates used for design provide for maximum release rate of 22.7 csm from the controlled drainage area.

The North Carolina Department of Transportation and Highway Safety was consulted on the modification of Secondary Road 1121 and the relocation of Secondary Road 1736. Their estimates of these road modification costs were included in the work plan.

Investigations

Foundation investigations of the structure sites were made with a core drill. A seismic survey was run in conjunction with the core drill investigation of structure No. 1. Results of these investigations indicate that there are no unusual problems to be encountered in construction.

Spillway material was found to be suitable for fill material. Additional borrow material will be taken from the permanent pools and will be inundated upon completion of construction. Locations are described in preliminary investigation reports.

Engineering and Watershed Planning Guide 34 was used to determine the required height of riprap on the two structures.

Further engineering investigations of the two planned structures were required after the Soil Conservation Service issued Technical Release 52. This publication revised the design criteria for the emergency spillways of structures having drainage areas of over 10 square miles. For the particular characteristics of the planned structures, it was determined that the emergency spillways would need to be located in rock. Engineers and geologists worked together closely in adjusting the physical configuration of the emergency spillways of the structures so that they would be located in rock.

Hydraulics and Hydrology

Analyses of the watershed were made using appropriate procedures set forth in the National Engineering Handbook, Section 4. Results of these analyses were used in the economic evaluation and in the design of proposed works of improvement.

The partial duration series of rainfall was developed using rainfall data from the United States Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States."

Hydrologic soil cover complexes were mapped in the field. These data were used to compute the rainfall-runoff relationship for the watershed.

The principal spillway, emergency spillway, and freeboard spillway hydrographs were developed in accordance with Chapter 21 of the National Engineering Handbook, Section 4.

The .5-, 1-, 2-, 5-, 10-, 25-, 50-, and 100-year frequency, 24-hour duration storms were routed through the watershed for the "with" and "without" project conditions using the TR-20 program.

Investigations

Geology

Preliminary geologic investigations were made on structure site Nos. 1 and 4. Investigations consisted of a study of all available literature, aerial photographs of the region, and a thorough surface examination of field conditions. A Failing 1500 core drill was used on both sites. On site No. 4, a seismic survey was run in conjunction with the core drill investigation. All preliminary information gathered and recorded indicates no unusual geologic problems will be encountered and that the sites are suitable for the proposed dams.

Further geologic investigations on the structures were made in connection with Technical Release 52 as described under the Engineering section. These investigations were involved mainly with determining the location of rock in relation to the layout of the emergency spillways. Also, further geologic investigations were made in 1973 to reconfirm that both of the planned structures would hold water and would have no excessive seepage problems. The sponsors retained a consulting engineering firm to evaluate the geologic report of the Soil Conservation Service and evaluate the sites' ability to hold water. The firm concurred in the findings of the Soil Conservation Service.

Sediment

Determination of sediment damages was accomplished by field examination of the entire flood plain area. Rates of soil movement and sediment production from sheet erosion were determined by using Musgrave's (38) formula which takes into account soil decline, percent of slopes, length of slope, rainfall, and cover conditions. Data for the formula were obtained from weighed acreage measurements of soil surveys of the watershed. Rates of erosion was determined for each land use. Cover factors used in the determination of future rates of soil movement were computed from anticipated use of the land in the future. Sediment storage was computed for both structure Nos. 1 and 4. An analysis was made of the cover complex, sheet erosion, and channel erosion in the watershed controlled by each structure. The total soil movement was determined, and appropriate delivery ratios were applied to calculate sediment storage requirements.

The sediment reduction benefits claimed in the economic evaluation were subjected to re-analysis during 1973. As a result of this analysis, it was determined that an additional sediment reduction benefit to Kerr Lake, a large Corps of Engineers impoundment on the Dan River, could be claimed.

Investigations

Economics

Methods used in making the economic investigations and analyses followed those approved by the Soil Conservation Service for the benefit-cost evaluation of land and water resource projects. Basic data were obtained from local farmers, state highway officials, Department of Agriculture publications, and other sources.

Adjusted normalized prices were used for agricultural benefit computations. Installation costs were based on 1973 prices. The costs of all structural measures were amortized over a 100-year period, using an interest rate of 5-5/8 percent.

Land use and yield information was obtained from the owners and operators of 25 percent of the flood plain acreage in the watershed, other farmers in the watershed, and from the district conservationist for Caswell County. The yields used in calculating more intensive land use benefits are those expected using good management and technology during the life of the project. The planned land use is within the capabilities of the flood plain soils.

Damageable values used in the evaluation of floodwater damages to crops and pasture in the flood plain below structures were based on predicted future without project acreages. Projected benefits were based on estimated future with project acreages. The following table summarizes expected land use changes in the flood plain below structures:

<u>Land Use</u>	<u>Present</u> (acres)	<u>Future Without Project</u> (acres)	<u>Future With Project</u> (acres)
Corn	131	96	369
Pasture	242	162	193
Tobacco	8	-	8
Idle	29	60	-
Woods	1,418	1,510	1,258
Miscellaneous	<u>92</u>	<u>92</u>	<u>92</u>
Total	1,920	1,920	1,920

The yields and net returns used in calculating damages are shown by the following table:

Future Without Project

<u>Land Use</u>	<u>Acres</u>	<u>Yield</u>	<u>Net-Return/Acre</u>
Corn	96	80. bu.	\$39.00
Pasture	162	3.5 AUM	\$12.00
Woods and Brush	1,570	--	\$ 2.00
Miscellaneous	92	--	-----

Expected gross returns provide the basis for determining damage factors for crops and pasture. When crops are partially or completely destroyed by floodwater, the unexpended costs of production are subtracted from expected gross returns in calculating damage factors. In calculating floodwater damages, these damage factors are applied by computer to the damageable values obtained with the land use and yields estimated for the future without project.

Damages to other agricultural improvements were calculated by computer and based on an estimated damage per acre inundated. The calculation of floodwater damages makes use of the frequency of flooding method of hydrological analysis.

Sediment, erosion, floodwater damage reduction, restoration of former productivity, and more intensive land use benefits were claimed for 570 acres of crop and pasture, and 1,258 acres of brush and woodland. There are 92 acres of flood plain land on which benefits were not evaluated, since it is projected that these areas will remain in farm roads, buildings, ditches, and other purposes.

Sediment and erosion benefits to land were based on the expected recovery of damaged land. These benefits were discounted where necessary for the length of the recovery period. Benefits were also calculated for prevention of land damage in the future with project, and appropriately discounted.

More intensive land use benefits were estimated on the basis of increased income from higher production resulting from more timely performance of farm operations and increased production inputs.

Indirect benefits were estimated to be 20 percent of non-agricultural benefits plus 10 percent of remaining benefits, excluding restoration of former productivity.

Municipal and industrial water benefits were estimated as follows:

Investigations

Millions of gallons-----	1,000
Value of raw water-----	\$100 per million gallons stored (10 cents per 1,000 gallons stored annually)
Average annual benefits-----	\$100,000

This estimation of benefits was made by a firm of consulting engineers retained by the sponsors and was occurred in by the Soil Conservation Service. Benefits were determined to exceed costs in accordance with Chapter 8 of the Economics Guide.

The recreational development at structure No. 4 will utilize 640 surface acres of water and 1,025 acres of land. The recreational facilities to be constructed are listed in Table 2B. There is a total population of approximately 750,000 persons within 50 miles of this development, mainly in industrial cities where population is steadily growing. The site of structure No. 4 is in a sparsely populated section of Caswell County, which will enhance its desirability as a camping and fishing area. It is also located near public hunting areas under North Carolina Wildlife Resources Commission management.

Benefits from recreation were estimated on a basis of 104,200 visitor-days per year at structure No. 4 and 30,800 visitor-days of incidental recreation at structure No. 1.

Local secondary benefits were determined in accordance with paragraph 102.02213 of the Watershed Protection Handbook and Chapter 11 of the Guide.

They were estimated by taking the sum of: 10 percent of direct primary benefits, 10 percent of added crop and pasture production costs, and 10 percent of annual associated costs.

Redevelopment benefits were estimated in accordance with the Economics Guide and paragraph 102.02212 of the Watershed Protection Handbook. Wage payments for local labor during construction were estimated to be equivalent to 20 percent of the construction costs. This value was amortized at 5-5/8 percent for 100 years to arrive at annual redevelopment benefits from this source. Fifty percent of the annual operation and maintenance cost was used as the value of annual wages paid to local labor. This value was treated as a decreasing annuity for 20 years at 5-5/8 percent interest and converted to an annual equivalent over the life of the project.

Biology

A biology field review was conducted by district biologists from the North Carolina Wildlife Resources Commission and the Soil Conservation Service. This was a team effort to determine the present fish and wildlife resources, potential for improvement, and possibilities of damage that could require mitigation. Other data, including the Catalog of the Inland Fishing Waters in North Carolina, prepared by the North Carolina

Investigations

Wildlife Resources Commission, were considered. All data collected were considered and included as part of the work plan investigation.

Forestry

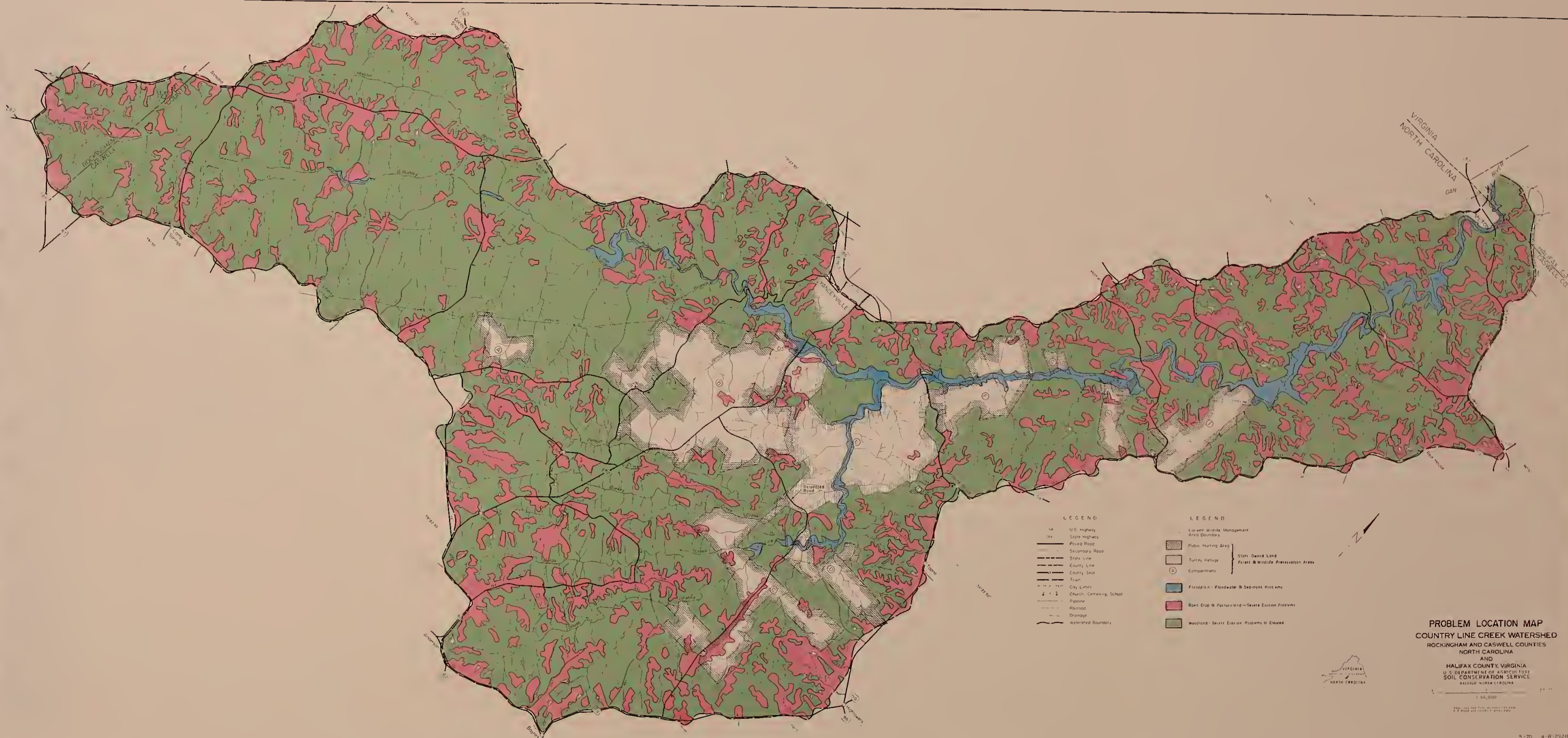
A systematic field survey showed ground cover, forest and hydrologic conditions, and treatment needs. The survey, supporting data, and information from other agencies and forestry officials determined the amount of remedial measures. The effects of the proposed works of improvement on fire hazard and risk were analyzed. The measures recommended contribute to flood reduction and soil stabilization.

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- LEGEND
- US Highway
 - State Highway
 - Paved Road
 - Secondary Road
 - State Line
 - County Line
 - County Seat
 - Town
 - City Limits
 - Church, Cemetery, School
 - Pipeline
 - Railroad
 - Drainage
 - Watershed Boundary

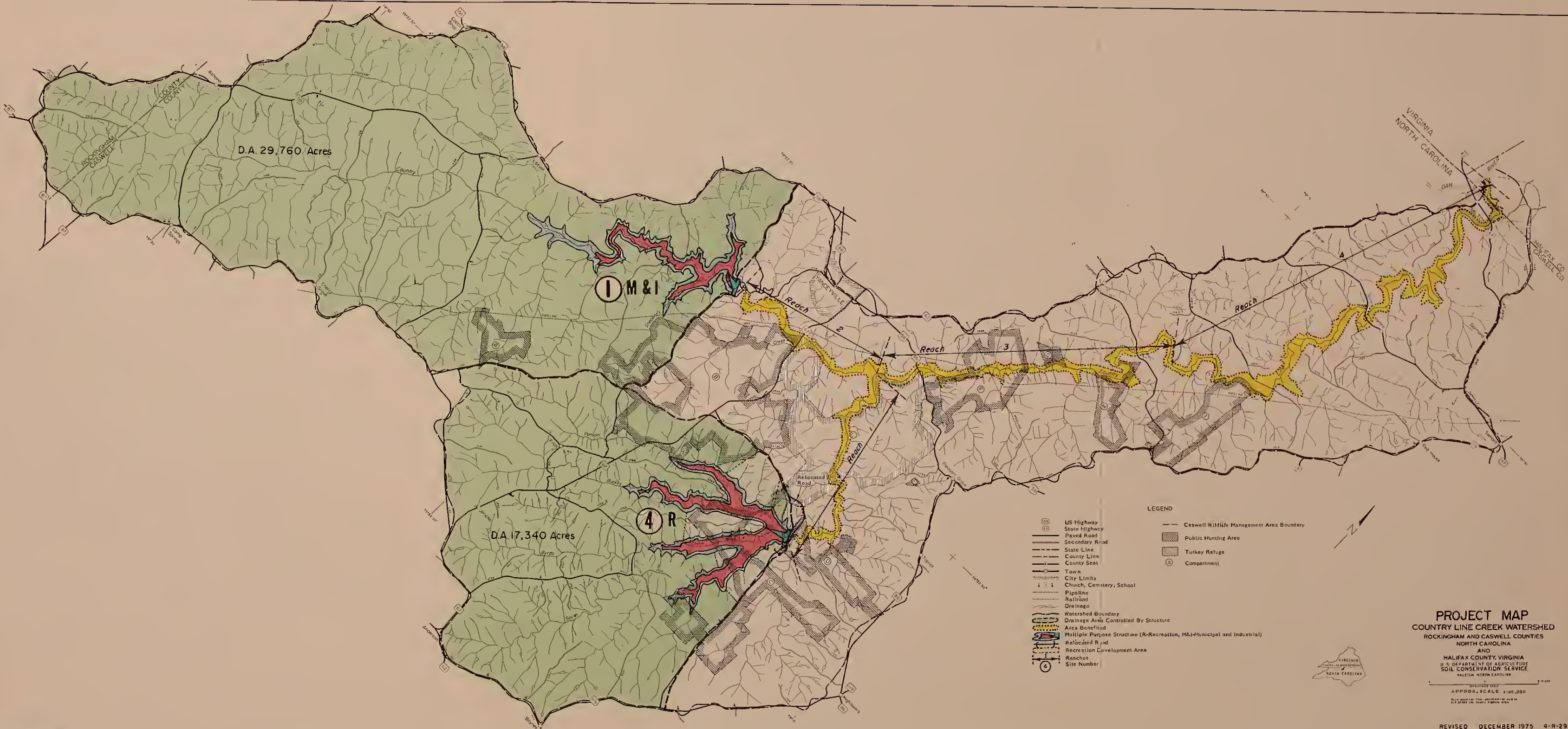
- LEGEND
- Caswell Wildlife Management Area Boundary
 - Public Hunting Area
 - Turkey Refuge
 - Compartment
 - Floodplain - Floodwater & Sediment Problems
 - Open Clog & Pastureland - Severe Erosion Problems
 - Woodland - Severe Erosion Problems if Cleared
 - State Owned Land
 - Forest & Wildlife Preservation Areas

PROBLEM LOCATION MAP
COUNTRY LINE CREEK WATERSHED
ROCKINGHAM AND CASWELL COUNTIES
NORTH CAROLINA
AND
HALIFAX COUNTY, VIRGINIA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WATERBORO, NORTH CAROLINA

1:50,000

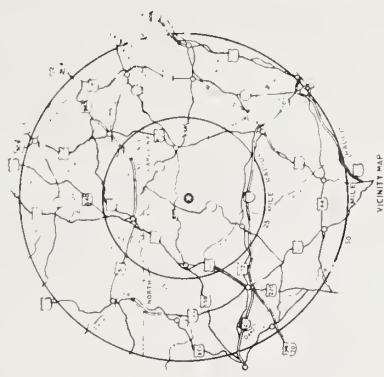
PREPARED BY THE SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE





PROJECT MAP
COUNTRY LINE CREEK WATERSHED
ROCKINGHAM AND CASWELL COUNTIES
NORTH CAROLINA
AND
HALIFAX COUNTY, VIRGINIA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
RALEIGH, NORTH CAROLINA

APPROX. SCALE 1:100,000
1" = 1 MILE
1" = 1.60934 KILOMETERS



- LEGEND
- 1 Boating Ramps
 - 2 Parking
 - 3 Bath House
 - 4 Picnic Shelter and Tables
 - 5 Restroom
- 1 Thru 6 Picnic, Camping, & Scenic Areas

STRUCTURE NO 4
RECREATIONAL DEVELOPMENT
 COUNTRY LINE CREEK WATERSHED
 CASWELL COUNTY, NORTH CAROLINA
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 RALEIGH, NORTH CAROLINA



